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ORIGINAL ARTICLE

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A 10-year update: national survey questionnaire of obstetric anesthesia units in Israel

D. Shatalin,[a,1] C.F. Weiniger,[b,c,1] I. Buchman,[a] Y. Ginosar,[b] S. Orbach-Zinger,[d] A. Ioscovich[a]

[a]*Department of Anesthesiology, Perioperative Medicine & Pain Treatment, Shaare Zedek Medical Center, Affiliated with the Hadassah-Hebrew University Medical School Ein-Kerem, Jerusalem, Israel*
[b]*Department of Anesthesiology, Hadassah Hebrew University Medical Center, Jerusalem, Israel*
[c]*Division of Anesthesia, Critical Care and Pain, Tel Aviv Sourasky Medical Center, Tel Aviv, Israel*
[d]*Department of Anesthesia, Rabin Medical Center (Beilinson Campus), Petah Tikvah, Tel Aviv University, Tel Aviv, Israel*

ABSTRACT

Background: This nationwide survey was conducted to provide data about the obstetric anesthesia services in Israeli labor and delivery units in 2016.

Methods: Prospective survey questionnaire was emailed to obstetric anesthesia unit directors/chairperson of all 25 labor and delivery services units within the jurisdiction of the Israeli Ministry of Health.

Results: The response rate was 100%. Nineteen (76%) units have dedicated anesthesiologist cover. Fifteen (60%) units offered nitrous oxide, four units (16%) offered patient-controlled intravenous fentanyl and six units (24%) offered patient-controlled intravenous remifentanil for alternative labor analgesia. The median (range) epidural rate was 60% (22–85%). The median (range) cesarean delivery rate was 20% (10–26%). Overall, general anesthesia was performed for median (range) 10% (1–25%) of cesarean deliveries. Neuraxial anesthesia was performed for 95% (40–99%) of elective and 60% (0–90%) of urgent cesarean deliveries. Intrathecal morphine was administered routinely for spinal anesthesia for post-cesarean delivery analgesia in 11 (44%) units. Nineteen (72%) units had a written aspiration prophylaxis protocol; 20 (80%) had a written labor analgesia protocol; 19 (76%) had a postdural puncture headache management protocol; 20 (80%) had a local anesthetic toxicity protocol; 24 units had Intralipid available in the unit.

Conclusion: No new labor units have opened since 2005, despite huge increases in delivery volume in many units. These units manage increased numbers of epidurals and cesarean deliveries. Use of intrathecal morphine for spinal anesthesia has become more widespread. Future efforts should focus on availability of emergency equipment, separate obstetric anesthesia staffing, and establishing emergency protocols.

Keywords: Epidural; Cesarean; Israel; Labor; National; Survey

Introduction

In Israel a child is born every three minutes and a cesarean delivery is performed every 18 minutes. During the calendar year 2015, there were 176 700 deliveries in Israel, and over 35 000 were defined as pregnancies at risk.[1] The obstetric anesthesia service is an integral part of the labor and delivery services, including preoperative and prenatal consultations and anesthesia for labor, caesarean delivery or postpartum complications such as hemorrhage.

In a previous Israeli survey of the 25 delivery units, performed in 2005, marked differences were noted in staffing patterns and protocols for anesthesia care for labor and delivery.[1] Globally protocols differ for medical staffing patterns, resident training, pain management and management of massive hemorrhage.[2,3]

The current nationwide survey of Israeli obstetric anesthesia units was conducted to provide a snapshot in 2016 of unit sizes, equipment availability, workload volume, labor anesthesia staffing patterns, organization of obstetric anesthesia services, analgesia for labor, anesthesia for cesarean delivery, training of anesthesia residents and obstetric anesthesia protocols, and to

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Correspondence to: Carolyn F. Weiniger, Division of Anesthesia, Critical Care and Pain, Tel Aviv Sourasky Medical Center, Tel Aviv, Israel.
E-mail address: carolynfweiniger@gmail.com
[1] The first two authors contributed equally to this study.

compare annual delivery volume and epidural and cesarean delivery rates with data gathered in 2005.

Methods

This prospective survey questionnaire study was performed in early 2017, and collected data generated in 2016. The survey received Institutional Review Board waiver Helsinki 0268–16-SZMC.

The survey questionnaire was constructed and underwent content and face validation by five members of the Israeli Association of Obstetric Anesthesia, who were not eligible to be surveyed. Each representative of labor and delivery services was initially contacted by one study investigator by telephone. After obtaining verbal consent, the survey was emailed to the 25 directors of obstetric anesthesia units or the chair of the Department of Anesthesiology that provided labor and delivery services within the jurisdiction of the Israeli Ministry of Health. Survey questionnaires were emailed in January 2017 with telephone follow-up over a three-month period. The survey requested data for January–December 2016. The questionnaires were formatted using a web-based survey site (Google forms). Responses were not anonymized, but respondents were told that their details would be disclosed only to the study team.

The survey about standard practice in representative units comprised five question categories with a total of 33 separate questions, and is shown in Appendix 1. Each question permitted a numerical or free text response: the five categories were a general question about the size of unit, staffing and training of anesthesia residents; analgesia options for labor; anesthesia for cesarean delivery; equipment available in the labor ward, and the use of protocols for routine and emergency obstetric anesthesia practice. All questions except Question 21 (Appendix 1) about anesthesia for external cephalic version were mandatory.

As in the 2005 survey,[1] labor and delivery units were categorized according to the annual delivery volume, and each unit provided details of their annual cesarean delivery and epidural analgesia rate in addition to details about available manpower.

Study outcomes were the frequencies of the responses. Annual delivery volume, epidural and cesarean delivery rates were compared with those from 2005.

The correlation between the annual delivery volume and the cesarean delivery rate; the annual delivery volume and the frequency of general anesthesia use for cesarean delivery; and the epidural rate and the rate of general anesthesia for urgent cesarean delivery, was determined.

Statistical analysis

Data were analyzed using IBM SPSS version 21.0.0 for Windows (IBM Corp. Armonk, NY). Continuous data are presented as mean ± standard deviation (SD) or median (interquartile range (IQR)[range]); categorical data are presented as count (percentage). A Wilcoxon signed-rank test was used to assess changes over time from 2005 to 2016 for the annual delivery volume, epidural and cesarean delivery rates; and is presented with Z and the P value, with $P < 0.01$ significant. Pearson correlation was performed for correlations, R-square was reported.

Results

Twenty-five labor and delivery units were surveyed with one respondent per unit. The response rate was 100%. Twenty-two respondents were obstetric anesthesia unit directors, while in three district medical centers with small anesthesiology departments they were chairmen. Three centers (12%) required more than two reminders; data collection was completed by the end of March 2017 (within three months following initial request). One center reported data for two units as obstetric anesthesia services for both units were covered centrally.

The total number of deliveries stated in the current survey of anesthesiologists in 2016 in Israel was 176 700. The Israel Health Ministry and the Israel Society of Maternal Fetal Medicine from the same period reported 181 405 live births; as previously reported, this count includes patients in East Jerusalem, but the figures were not included in the current survey because their jurisdiction falls under the Palestinian Ministry of Health.

The 25 units are presented according to delivery volume (Table 1). The annual number of deliveries ranged from 1898 to 16 023. This is an increase from the 2005 survey, where three units received <2500 deliveries and only one received >12500 deliveries per annum (Fig. 1). A Wilcoxon signed-ranks test indicated that the median post-test ranks were significantly different, $Z = -4.292$, $P < 0.0001$; median (range) 5500 (1898–16 023) and 4500 (900–12 000) for 2016 and 2005 respectively.

Of the 25 units, six are tertiary and 19 are district hospitals. Tertiary hospitals are full trauma centers with cardiac and neurosurgery capabilities. Nineteen (76%) of the surveyed institutions have authorized training programs in anesthesiology. Nineteen (76%) units surveyed have dedicated anesthesiologist cover (Table 1). This represents an improvement, as only 11/25 (44%) reported dedicated cover in the previous survey. Three units with 2500–4999 deliveries, two units with 5000–7499 deliveries and one unit with 7500–9999 deliveries reported no dedicated anesthesia cover to provide epidurals on demand. Seventeen units (68%) reported that night-cover was provided by a resident. Seven (28%) units did not have operating rooms in the labor ward, one of which had greater than 10 000 deliveries per annum.

Table 1 Staffing and the organization of obstetric anesthesia services. Data presented both as pooled data and also stratified according to number of deliveries per year

Hospitals graded by deliveries. yr^{-1} (no. hospitals)	Dedicated anesthetist for labor ward (no. hospitals)		Have operating room adjacent to labor ward
	All shifts n=25	Day shift n=25	
<2500 (n=1)	0	0	1 (25%)
2500–4999 (n=10)	6 (60%)	6 (60%)	6 (60%)
5000–7499 (n=4)	2 (50%)	4 (100%)	2 (50%)
7500–9999 (n=5)	4 (80%)	4 (80%)	5 (100%)
≥10 000 (n=5)	4 (80%)	4 (80%)	4 (80%)
Pooled data (range) [interquartile range]	19 (76%)	19 (76%)	18 (72%)

Key: Data presented as frequency data. Percentages are presented according to strata.

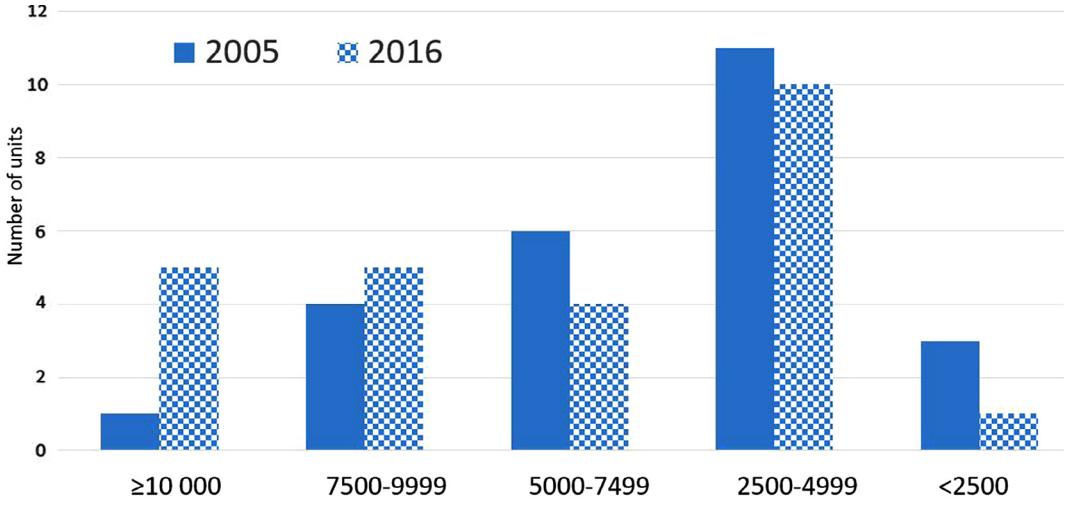

Fig. 1 The annual delivery volume reported in 2005 and the current 2016 survey are presented, categorized in five groups: ≥10 000, 7500–9999, 5000–7499, 2500–2999 and <2500 deliveries. In 2005 only one institution had ≥10 000 deliveries whereas in 2016 there were five such units.

Fifteen (60%) units offered nitrous oxide, four units (16%) offered patient-controlled intravenous fentanyl and six units (24%) offered patient-controlled intravenous remifentanil for alternative labor analgesia (Table 2).

A Wilcoxon signed-rank tests indicated that the median post-test ranks were similar ($Z = -1.719$, $p = 0.09$). The median (range) epidural rate was 60% (22–85%), a non-significant increase in rate from 50% (15–93%) reported in 2005, although the denominator (annual delivery volume) has increased significantly (Table 2). As seen in the 2005 survey, there was no relationship between epidural rate and annual delivery volume (R-square 0.010, P = 0.96).

Table 2 Choice of analgesia for labor. Data presented both as pooled data and also stratified according to number of deliveries per year

	Epidural rate Median (IQR)[range]	Intravenous fentanyl no. units n=25	Intravenous Remifentanil no. units n=25	Entonox no. units n=25
<2500 (n=1)	22	0	0	0
2500–4999 (n=10)	65 (43–71)[30–85]	2 (20%)	2 (20%)	7 (70%)
5000–7499 (n=4)	57 (40–76)[35–82]	0	1 (4%)	4 (16%)
7500–9999 (n=5)	61 (46–73)[36–75]	2 (40%)	2 (40%)	3 (60%)
≥10 000 (n=5)	60 (30–75)[30–75]	0	1 (4%)	1 (4%)
Pooled data	60 (42–73)[22–85]	4 (16%)	6 (24%)	15 (60%)

Key: Data presented as median (interquartile range=IQR)[range]; percentages presented according to strata.

The median (range) cesarean delivery rate was 20% (10–26%), similar to the previous survey that reported 20% (10–27%), ($Z = -0.152$, $P = 0.88$). Overall, general anesthesia was performed for median (range) 10% (1–25%) of cesarean deliveries; 10% (0–92%) urgent cesarean deliveries. Neuraxial anesthesia was performed for

Table 3 The cesarean delivery rate and choice of anesthesia for cesarean delivery. Data presented both as pooled data and also stratified according to number of deliveries per year

Hospitals stratified by deliveries/y (no. hospitals)	CD rate Median (IQR) [range]	Anesthesia mode			
		GA	Spinal	GA urgent CD	Spinal urgent CD
<2500 (n=1)	21	6	92	10	86
2500–4999 (n=10)	21 (19–23) [10–25]	14 (7–26) [1–50]	90 (73–98) [63–99]	10 (10–34 [0–80]	60 (22–83) [0–90]
5000–7499 (n=4)	23 (13–26) [10–26[	8 (6–10) [5–10]	97 (93–98) [91–98]	10 (3–18) [0–20]	65 (35–80)[30–80]
7500–9999 (n=5)	20 (16–22) [15–24]	12 (7–19) [3–25]	90 (88–96) [88–97]	30 (14–35) [3–39]	60 (38–65) [26–70]
≥10 000 (n=5)	17 (11–21) [10–21]	8 (5–52) [5–75]	95 (60–97)[40–99]	30 (13–76) [10–92]	70 (14–80) [8–80]
Pooled data	20 (10–22) [10–26]	10 (17–22) [1–75]	95(83–98) [40–99]	10 (10–30) [0–92]	60 (28–80) [0–90]

Key: Data presented as median (interquartile range = IQR)[range]; GA = general anesthesia; CD = cesarean delivery; no = number; y = year.

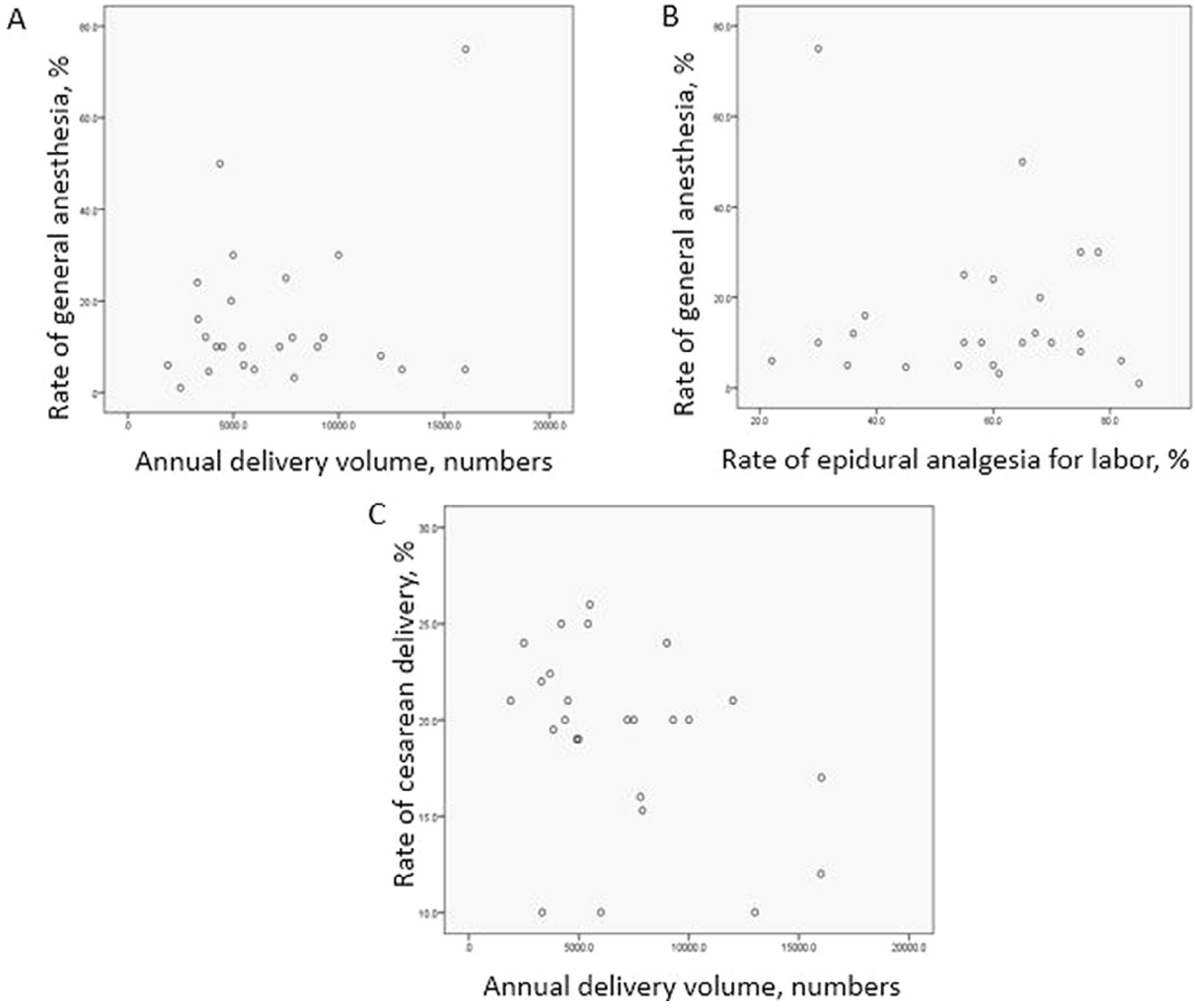

Fig. 2 Scatterplots showing there was no significant correlation between annual delivery volume and rate of general anesthesia (GA) for cesarean delivery (A); rate of epidural analgesia and rate of GA for cesarean delivery (B); and annual delivery volume and rate of cesarean delivery (C). Fig. 2A shows two units with higher GA rates; both have higher Arab populations. Although there was no significant correlation between rates of epidural analgesia for labor and general anesthesia for cesarean delivery, one unit with a very low epidural rate (30%) had an almost 80% GA rate for cesarean delivery (2B)

95% (40–99%) elective and 60% (0–90%) urgent cesarean deliveries, Table 3.

There was no relationship when we performed a post-hoc Pearson correlation to assess for associations between the annual delivery volume and the cesarean delivery rate, R-square −0.392, $P = 0.053$; the annual delivery volume and the frequency of general anesthesia use for cesarean delivery, R-square 0.266, $P = 0.20$; and the epidural rate and the rate of general anesthesia for urgent cesarean delivery, R-square 0.042, $P = 0.84$ (Fig. 2).

Intrathecal morphine was administered routinely for spinal anesthesia for postcesarean delivery analgesia in 11 (44%) units.

There were variations in the types of protocols available in the labor and delivery centers (Table 4), and most, 24 (96%) units had Intralipid available in the labor ward. In 18 (72%) units tranexamic acid was routinely administered to women when postpartum hemorrhage occurred.

Equipment availability in the labor ward is shown in Table 5. Transfers to the intensive care unit varied from zero to 38 women, and transfer was strongly correlated with to annual delivery volume, R-square 0.679, $P < 0.0001$.

Twenty-three (92%) departments held regular anesthesia departmental meetings that discussed labor ward practices, and 15 (60%) held interdisciplinary meetings to debate the management of complicated patients (Table 5). Twelve (48%) units participated in research projects in the labor ward.

Discussion

This updated survey of all 25 labor and delivery units in Israel reports a significant increased demand for labor anesthesia services provided in most Israeli labor and delivery units.

Most hospitals (76%) have dedicated anesthesia staff for obstetric units, an improvement from the 44% reported in the previous survey.[1] This is comparable to the United Kingdom where 61% of the obstetric units reported dedicated anesthesia staff and resources for elective (but not emergency) cesarean deliveries.[4] In France, centers with dedicated obstetric anesthesia staff increased from 21.5% in 2003 to 38.9% in 2010.[5] In the Czech Republic, 22 (45%) centers reported separate anesthesia staff for obstetric services.[6]

Obstetric anesthesia staffing varies between day and night: 68% of hospitals residents perform most activities at night. Similar to France (66% in 2010), 72% of Israeli centers have obstetric operating rooms located within or adjacent to the delivery ward.[5]

Remifentanil is a synthetic short-acting opioid which may be useful in provision of pain of labor analgesia in cases when epidural analgesia is contraindicated,[7,8] despite reports of respiratory depression and hypoxic cardiac arrest.[8,9] In France, PCA administration of remifentanil was used in 52% of all centers.[10] In the United Kingdom, 49% of centers reported using remifentanil PCA,[11] greater than 36% (95% CI 25.7 to 46.3%) reported in United States academic centers.[8] A Belgian

Table 4 Written local protocols for routine and emergency obstetric anesthesia practice.

Units	Written local protocols n=25 units surveyed					
	Labor analgesia	MTP	Aspiration prophylaxis	PDPH	LA toxicity	LW multidisciplinary protocols
<2500 (n=1)	1 (4%)	1 (4%)	1 (4%)	1 (4%)	1 (4%)	1 (4%)
2500–4999 (n=10)	9 (36%)	9 (36%)	9 (36%)	9 (36%)	9 (36%)	7 (28%)
5000–7499 (n=4)	3 (12%)	1 (4%)	3 (12%)	1 (4%)	2 (8%)	2 (8%)
7500–9999 (n=5)	4 (16%)	4 (16%)	4 (16%)	4 (16%)	4 (16%)	3 (12%)
≥10 000 (n=5)	3 (12%)	3 (12%)	2 (8%)	4 (4%)	4 (16%)	2 (8%)
Pooled data for all hospitals	20 (80%)	18 (72%)	19 (76%)	19 (76%)	20 (80%)	15 (60%)

Data presented both as pooled data and also stratified according to number of deliveries per year. Data are number (%); MTP = massive transfusion protocol; LA = local anesthetic. PDPH: postdural puncture headache. LW: labor ward.

Table 5 Equipment available data presented both as pooled data and also stratified according to number of deliveries per year.

	Video-laryngoscope	US	Cell saver	Rapid infusor	TEG
<2500 (n=1)	1 (4%)	1 (4%)	1 (4%)	1 (4%)	1 (4%)
2500–4999 (n=10)	7 (28%)	10 40%)	2 (8%)	9 (36%)	6 (24%)
5000–7499 (n=4)	4 (16%)	1 (4%)	2 (8%)	3 (12%)	3 (12%)
7500–9999 (n=5)	4 (16%)	3 (12%)	2 (8%)	3 (12%)	3 (12%)
≥10 000 (n=5)	5 (20%)	1 (4%)	2 (8%)	4 (16%)	3 (12%)
Pooled data for all hospitals	21 (84%)	6 (24%)	9 (36%)	20 (80%)	16 (64%)

Data presented as frequency data. US = Ultrasound; TEG = Thromboelastography.

survey reported that 36% of labor units use opioids, and remifentanil is the first drug of choice in 76.5%, followed by sufentanil in 23.5%.[12] The use of remifentanil in the Czech Republic is only 2.4%[13] and is currently nonexistent in Slovakia.[14] Forty percent of Israeli units provide intravenous opioid PCA, usually fentanyl, and remifentanil PCA is available in a quarter of the units, but widespread use of remifentanil is likely limited by the lack of 1:1 nursing supervision. Our survey did not ask about respiratory monitoring, staffing ratios or major adverse events using intravenous opioid analgesia for labor analgesia.[9]

The rate of epidural administration increased from 50% (range 15–93%) in 2005 to 60% (range 22–85%) in 2016. United States data indicate that large volume institutions witnessed increased epidural usage from 35% in 2001 to 78% over 10 years.[2] In Belgium epidural analgesia was used by 68% (range 25–85%) of laboring women.[12] Epidural analgesia and neuraxial anesthesia rates remain low in some countries; for example prior to 2005 Croatia reported a 1% epidural analgesia rate and a 7% neuraxial rate for cesarean deliveries outside the university setting.[3] The authors attribute these low numbers to lack of medical staff and training of anesthesiologists. In Japan, according to the Ministry of Health, Labor and Welfare the epidural analgesia rate in 2016 is strikingly low, 6.1%,[15] possibly related to the charges levied for epidural analgesia, shortage of trained staff, cultural factors and lack of information for patients.[16] In Israel, cultural factors affect rates of epidural analgesia: in hospitals with a large Arab population the rate of epidural analgesia was found to be lower than in other units. In the United States, the low uptake of neuraxial analgesia has been attributed to language barriers and lack of timely information.[17] In Israeli centers, lack of timely information, but not language barriers, may play a part.

Increased obstetric anesthesia workload has been noted in recent years, due to an increase in both the cesarean delivery rate (9.6% in 1992 to 18% in 2004 and to over 20% in 2010) and epidural analgesia rates for labor.[1,18] The rate of general anesthesia for cesarean deliveries remains at 10%. In the Czech Republic the number of cesarean deliveries has almost tripled in the past 20 years from 8.9% to 24.4%,[6] and in 2011 general anaesthesia was used in 44.4% of all cesarean deliveries. This high rate of general anesthesia cannot be attributed predominantly to emergency surgery as general anesthesia was administered for 34% of elective cesarean deliveries. In North American centers, the cesarean delivery rate in 2007 was 30% (IQR 25.5–32.5%), where 5% were performed under general anesthesia.[19]

One striking improvement is that 44% of labor and delivery units now administer intrathecal morphine for post-cesarean delivery analgesia. A survey in 2014 found it used in only 12% of units.[20]

The use of protocols, important in emergency situations, [21] has increased compared to the results from 2005.[1] For example, a protocol for labor room epidural analgesia is employed in 80% of hospitals (68% in 2005), and an aspiration prophylaxis protocol is used in 76% of hospitals (48% in 2005).

The use of thromboelastography (TEG) is not widespread in Israel. This may be related to difficulty interpreting the results, lack of standardization and lack of direct access to the results,[22] despite evidence that use of viscoelastic testing may reduce the need for blood products.[23] However, our survey indicated its use in 60% of units, which compared favorably to 42% of obstetric units in Germany.[24]

Tranexamic acid (TXA), an antifibrinolytic agent which acts by binding competitively with the plasminogen insertion point with fibrin, has demonstrated some benefit in the obstetric population.[25] The WOMAN (Woman Maternal Antifibrinolytic) trial reported decreased deaths due to bleeding and laparotomy to control bleeding, and although contentious regarding the study rates of bleeding, importantly showed no evidence of adverse effects in 20 000 women administered TXA.[26] The survey indicated that 72% of units use TXA routinely for high-risk patients, a similar finding to Germany which reported use in over 80% of units.[24]

Difficulty in airway management is more common in obstetric patients and there is some evidence for the use of videolaryngoscopy in obstetrics.[27] This equipment was available in 84% of units.

There are several important study limitations. Firstly, this does not reflect the individual practice variations within departments as only the Unit Director or Department Chairman was asked to respond. We did not ask about post-cesarean analgesia or labor analgesia regimens. We did not ask in this or the previous survey about use of combined-spinal epidurals (CSE) for labor analgesia. There are recent data that CSE may improve the efficacy of epidural analgesia for labor, in particular to reduce failed epidural analgesia for cesarean delivery.[28] Finally, for cesarean delivery care we did not inquire about strategies to avoid spinal hypotension, (preloading or coloading, table tilt, vasopressor treatment of prophylaxis).[29,30] We report a wide range of bupivacaine doses and this will be investigated in a future study.

Conclusion

There are no additional labor units since 2005, despite significant increases in annual delivery volume in many units. These units manage increased numbers of epidurals and cesarean deliveries. In 2017 one new unit was opened and its data will be assessed in future surveys. Use of intrathecal morphine for spinal anesthesia has become more widespread in Israel. Future efforts should

focus on availability of emergency equipment and dedicated obstetric anesthesia staffing, and on establishing emergency protocols.

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Conflicts of interest

None.

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References

1. Weiniger CF, Ivri S, Ioscovich A, Grimberg L, Evron S, Ginosar Y. Obstetric anesthesia units in Israel: a national questionnaire-based survey. *Int J Obstet Anesth* 2010;**19**:410–6.
2. Traynor AJ, Aragon M, Ghosh D, et al. Obstetric anesthesia workforce survey: A 30-year update. *Anesth Analg* 2016;**122**:1939–46.
3. Kopic D, Sedensky M, Owen M. The impact of a teaching program on obstetric anesthesia practices in Croatia. *Int J Obstet Anesth* 2009;**18**:4–9.
4. McGarrity L, O'Connor R, Young S. A national survey of obstetric anaesthesia guidelines in the UK. *Int J Obstet Anesth* 2008;**17**:322–8.
5. Ducloy-Bouthors AS, Prunet C, Tourres J, Chassard D, Benhamou D, Blondel B. Medical care organization in analgesia, anaesthesia and intensive care in maternity units: results from the National Perinatal Surveys in 2003 and 2010. *Ann Fr Anesth Reanim* 2013;**32**:18–24.
6. Stourac P, Blaha J, Klozova R, et al. Anesthesia for cesarean delivery in the Czech Republic: a 2011 national survey. *Anesth Analg* 2015;**120**:1303–8.
7. Stocki D, Matot I, Einav S, Eventov-Friedman S, Ginosar Y, Weiniger CF. A randomized controlled trial of the efficacy and respiratory effects of patient-controlled intravenous remifentanil analgesia and patient-controlled epidural analgesia in laboring women. *Anesth Analg* 2014;**118**:589–97.
8. Aaronson J, Abramovitz S, Smiley R, Tangel V, Landau R. A survey of intravenous remifentanil use for labor analgesia at academic medical centers in the United States. *Anesth Analg* 2017;**124**:1208–10.
9. Weiniger CF, Carvalho B, Stocki D, Einav S. Analysis of physiological respiratory variable alarm alerts among laboring women receiving remifentanil. *Anesth Analg* 2017;**124**:1211–8.
10. Hanouz JL, Simonet T, Marliot C, et al. French national survey on remifentanil utilisation for obstetrical peridural analgesia. *Ann Fr Anesth Reanim* 2012;**31**:682–6.
11. Saravanakumar K, Garstang JS, Hasan K. Intravenous patient-controlled analgesia for labour: a survey of UK practice. *Int J Obstet Anesth* 2007;**16**:221–5.
12. Lavand'homme P, Roelants F. Patient-controlled intravenous analgesia as an alternative to epidural analgesia during labor: questioning the use of the short-acting opioid remifentanil. Survey in the French part of Belgium (Wallonia and Brussels). *Acta Anaesthesiol Belg* 2009;**60**:75–82.
13. Stourac P, Kosinova M, Harazim H, et al. The analgesic efficacy of remifentanil for labour. Systematic review of the recent literature. *Biomed Pap Med Fac Univ Palacky Olomouc Czech Repub* 2016;**160**:30–8.
14. Blaha J, Stourac P, Grochova M, et al. Labor analgesia in Czech Republic and Slovakia: a 2015 national survey. *Int J Obstet Anesth* 2018;**35**:42–51.
15. https://qz.com/1062161/a-string-of-tragedies-is-giving-painless-childbirth-via-epidurals-an-even-worse-rep-than-before-in-japan/ Accessed July 25, 2018.
16. Ohashi Y, Baghirzada L, Sumikura H, Balki M. Remifentanil for labor analgesia: a comprehensive review. *J Anesth* 2016;**30**:1020–30.
17. Toledo P, Sun J, Grobman WA, Wong CA, Feinglass J, Hasnain-Wynia R. Racial and ethnic disparities in neuraxial labor analgesia. *Anesth Analg* 2012;**114**:172–8.
18. Ginosar Y, Ioscovich A, Weissman C, Calderon-Margalit R, Weiniger CF. Comparison of the obstetric anesthesia activity index with total delivery numbers as a single denominator of workload demand in Israeli maternity units. *Isr J Health Policy Res* 2012;**1**:48.
19. Wilkins KK, Greenfield ML, Polley LS, Mhyre JM. A survey of obstetric perianesthesia care unit standards. *Anesth Analg* 2009;**108**:1869–75.
20. Orbach-Zinger S, Ioscovich A, Aviram A, et al. National survey of postoperative pain control after cesarean delivery. *Isr Med Assoc J* 2014;**16**:153–6.
21. Shields LE, Wiesner S, Fulton J, Pelletreau B. Comprehensive maternal hemorrhage protocols reduce the use of blood products and improve patient safety. *Am J Obstet Gynecol* 2015;**212**:272–80.
22. Othman M, Falcon BJ, Kadir R. Global hemostasis in pregnancy: are we using thromboelastography to its full potential? *Semin Thromb Hemost* 2010;**36**:738–46.
23. Collins PW, Cannings-John R, Bruynseels D, et al. Viscoelastometry guided fresh frozen plasma infusion for postpartum haemorrhage: OBS2, an observational study. *Br J Anaesth* 2017;**119**:422–34.
24. Kaufner L, Ghantus K, Henkelmann A, et al. Haemostatic management in postpartum haemorrhage: Nationwide survey in Germany. *Anaesthesist* 2017;**66**:491–9.
25. Simonazzi G, Bisulli M, Saccone G, Moro E, Marshall A, Berghella V. Tranexamic acid for preventing postpartum blood loss after cesarean delivery: a systematic review and meta-analysis of randomized controlled trials. *Acta Obstet Gynecol Scand* 2016;**95**:28–37.
26. WOMAN Trial Collaborators. Effect of early tranexamic acid administration on mortality, hysterectomy, and other morbidities in women with post-partum haemorrhage (WOMAN): an international, randomised, double-blind, placebo-controlled trial. *Lancet* 2017;**389**:2105–16.
27. Scott-Brown S, Russell R. Video laryngoscopes and the obstetric airway. *Int J Obstet Anesth* 2015;**24**:137–46.
28. Mankowitz SK, Gonzalez Fiol A, Smiley R. Failure to extend epidural labor analgesia for cesarean delivery anesthesia: a focused review. *Anesth Analg* 2016;**123**:1174–80.
29. Kinsella SM, Carvalho B, Dyer RA, et al. International consensus statement on the management of hypotension with vasopressors during caesarean section under spinal anaesthesia. *Anaesthesia* 2018;**73**:71–92.
30. Lee AJ, Landau R, Mattingly JL, et al. Left lateral table tilt for elective cesarean delivery under spinal anesthesia has no effect on neonatal acid-base status: a randomized controlled trial. *Anesthesiology* 2017;**127**:241–9.

Appendix

Questionnaire for Obstetric Anesthesia Units Managers

A. General

1. What are the number of deliveries in a year in your obstetric unit?
2. What is the number of attending anesthesiologist and residents in the delivery room at the following time (morning shift)?
   A. In the morning shift (usually 08:00-16:00)
   - attending anesthesiologist _____
   - residents _____

   B. In the evening shift (usually 16:00-23:00)
   - attending anesthesiologist _____
   - residents _____

   C. In the night shift (usually 23:00-8:00)
   - attending anesthesiologist _____
   - residents _____
3. Does your educational curriculum include a separate rotation in the obstetric anesthesia unit?
   - Yes
   - No
4. Do residents with less than of a year of experience in their residency work in the delivery room?
   - Yes
   - No
5. Is there an dedicated anesthesiologist in the delivery room at the following time?

A. In the morning shift (usually 08:00-16:00)
   - Yes
   - No

B. In the evening shift (usually 16:00-23:00)
   - Yes
   - No

C. In the night shift (usually 23:00-8:00)
   - Yes
   - No

6. Does your unit perform research in the field of obstetric anesthesia?
   - Yes
   - No
7. Are there departmental meetings with presentations on obstetric anesthesia topics?
   - Yes
   - No
8. If there are such meetings, what is the frequency of those meetings?_____

B. Analgesia for labor

9. What is the percent of epidural for labor analgesia performed in the unit?_____
10. Is nitrous oxide used in the delivery ward?
    - ☐ Yes
    - ☐ No
11. Are IV PCA's used for labor analgesia?
    - ☐ Yes
    - ☐ No
12. Is IV Remifentanyl used in the delivery room?
    - ☐ Yes
    - ☐ No

C. Anesthesia for cesarean delivery

13. What is the percent of cesarean section deliveries performed in a year?_____
14. What is the number of operating room adjacent to the delivery room? (only for the purpose of a delivery room)?_____
15. What is the overall percent of general anesthesia performed for cesarean section delivery in the hospital?
16. What percent of the general anesthesia performed is for emergency cases?
17. What is the percent of spinal anesthesia performed for cesarean section deliveries?
18. Does your unit routinely use intrathecal morphine for spinal anesthesia for post-cesarean delivery analgesia?
19. Which anesthetic technique is used for revisions of the uterine cavity / manual removal of the placenta?
    - Spinal anesthesia
    - General anesthesia with intubation
    - General anesthesia without intubation
20. External Cephalic Version (ECV) is performed
    - Without anesthesia
    - Under spinal anesthesia
    - Other
21. What is the local anesthesia dosage and additional opioids protocol used in spinal anesthesia for External Cephalic Version (ECV)?_____
    (Not mandatory question. Answer only, if you choose spinal anesthesia in previous question)

D. Equipment available in the labor ward

22. Is there a videolaringoscope allocated only for use in the delivery room?
    - ☐ Yes
    - ☐ No

23. Is an US used in routine obstetric anesthesia practice in your unit?
    - ☐ Yes
    - ☐ No
24. Is cell salvage used for clinical practice in your unit?
    - ☐ Yes
    - ☐ No
25. Is a Rapid Infusion System or Level one used for clinical practice in your unit?
    - ☐ Yes
    - ☐ No
26. Is point of care testing (TEG) performed in your unit?
    - ☐ Yes
    - ☐ No

E. The use of protocols for routine and emergency obstetric anesthesia practice

27. Is there a departmental protocol designed for cases of massive obstetric bleeding?
    - ☐ Yes
    - ☐ No
28. Is there a departmental protocol designed for prevention aspiration?
    - ☐ Yes
    - ☐ No
29. Is there a treatment protocol designed for cases of PDPH?
    - ☐ Yes
    - ☐ No
30. Is there a treatment protocol for local anesthesia toxicity in your unit?
    - ☐ Yes
    - ☐ No
31. Is there a standardized epidural for labor analgesia protocol?
    - ☐ Yes
    - ☐ No
32. Are there written guidelines regarding working in the delivery room?
    - ☐ Yes
    - ☐ No
33. What is the amount of cases that are admitted to the ICU in a year?_____