

Occasional Reviews

Obstetrical anaesthesia in Ontario

John Oyston MB BS FFARCS

The purpose of this study was to determine the availability of regional anaesthesia for Caesarean section, of epidural opioids and patient-controlled analgesia after Caesarean section, and of epidural and other forms of analgesia in labour. A mail survey was sent to the "Head Nurse, Department of Obstetrics" at each of the 142 hospitals in Ontario with designated obstetric beds. Responses were obtained from 100% of hospitals. For Caesarean Section, general anaesthesia was used in all hospitals, and was the only option in seven. Epidural anaesthesia was used in 93% of hospitals, and spinal anaesthesia in 48%. Postoperatively, patient-controlled analgesia was used in 31% of hospitals and spinal opioids in 28%. In 66 hospitals, im or iv opioids were the only types of analgesia available. For analgesia in labour, im or iv opioids were used in 96% of hospitals, nitrous oxide was used in 75%, epidural analgesia in 75%, transcutaneous electrical nerve stimulation in 52% and patient-controlled analgesia in 10%. The overall epidural rate was 38%. Although the average rate in the 73 hospitals with fewer than 500 births per year was only 6%, 14 large hospitals had an epidural rate of 60% or higher. It is concluded that regional techniques for peripartum analgesia have been widely accepted. Analgesia after Caesarean section could be improved. Epidural analgesia should be more widely available, especially in the many small hospitals in Ontario.

Cette étude vise à évaluer pour la césarienne la disponibilité de l'anesthésie régionale, des morphiniques épiduraux et de l'analgésie autocontrôlée après l'intervention, et de l'analgésie épidurale ou autre pendant le travail. Un questionnaire est expédié par la poste à l'infirmière-chef de chacun des 142 hôpitaux de l'Ontario à vocation obstétricale. Tous les hôpitaux

Key words

ANAESTHESIA: obstetrical;

ANALGESIA: obstetrical; epidural.

From the Department of Anaesthesia, Orillia Soldiers' Memorial Hospital, 170 Colborne Street West, Orillia, Ontario, L3V 2Z3.

Supported by the physicians of Ontario through the PSI Foundation.

Accepted for publication 8th July, 1995.

ont répondu. Pour la césarienne, l'anesthésie générale est administrée dans tous les hôpitaux et consiste en la seule option dans sept de ceux-ci. L'anesthésie épidurale est utilisée dans 93% des hôpitaux et la rachianesthésie dans 48%. A la période postopératoire l'analgésie autocontrôlée est utilisée dans 31% des hôpitaux et les opiacés par injection rachidienne dans 28%. Dans 66 hôpitaux, seuls les opiacés sont disponibles. Pour l'analgésie pendant le travail, les morphiniques im ou iv sont utilisés dans 96% des hôpitaux, le protoxyde d'azote dans 75%, la stimulation nerveuse électrique transcutanée dans 52% et l'analgésie autocontrôlée dans 10%. Le pourcentage global des épidurales est de 38%. Bien que le taux moyen de 73 hôpitaux de moins de 500 lits par année soit seulement de 6%, 14 grands hôpitaux ont un taux de 60% et plus. En conclusion, l'anesthésie épidurale pour la césarienne est largement acceptée. L'analgésie postcésarienne pourrait être améliorée. L'anesthésie épidurale devrait être beaucoup plus disponible, surtout dans plusieurs petits hôpitaux de l'Ontario.

In an ideal world, every woman giving birth in hospital would have access to the best possible obstetrical anaesthesia and analgesia. This would include:

- 1 The option of a regional anaesthetic technique if a Caesarean section were required. This would avoid the risks of general anaesthesia in pregnancy, allow both parents to witness the birth, and encourage early bonding.
- 2 Good postoperative analgesia after Caesarean section, using spinal opioids or patient-controlled analgesia (PCA), which are more effective than intermittent intramuscular injections.¹
- 3 Access to a variety of types of analgesia in labour. This should include epidural analgesia, which is the most effective analgesic in labour, and which results in the highest patient satisfaction.²

Anecdotal evidence suggests that, despite supposedly universal health care, many women in Ontario do not have access to these services. A study in British Columbia in 1982³ demonstrated considerable deficits in obstetric anaesthesia care. All Caesarean sections were performed using general anaesthesia in 26% of hospitals and there was no obstetric epidural service in 36% of hospitals. A province-wide study of obstetrical anaesthesia has not

been done in Ontario since 1982, when Adamson *et al.*⁴ found that 54% of hospitals provided epidural analgesia, and that the overall epidural rate was 34%.

This paper describes a study of all hospitals in Ontario with designated obstetrical beds, to determine the availability of obstetrical anaesthesia services, and to investigate the availability of epidural analgesia during labour.

Methods

Data collection

A survey form (Appendix) was sent to each of the 160 hospitals in Ontario with obstetrical beds listed in either the "Canadian Hospital Directory 1991-2" or the "Guide to Canadian Health Care Facilities 1994-5" (Canadian Hospital Association, CHA Press, Ottawa, Ontario).

The survey was formulated according to Dillman's "Total Design Method".⁵ A pilot study was performed in New Brunswick. The form asked about the type of anaesthesia and postoperative analgesia used for Caesarean section. There were questions about analgesia in labour, and especially about the availability of epidural analgesia and the use of epidural infusions. There were also questions about the number and availability of anaesthetists, the number of deliveries and Caesarean sections in the previous year.

The survey was mailed to "The Head Nurse, Department of Obstetrics," along with a covering letter and a stamped addressed return envelope, in August 1994. Non-responders were sent reminders in September and October and were asked to complete the survey by telephone in November.

Additional data were obtained from two other sources. The "Guide to Canadian Health Care Facilities 1994-1995" provided the total number of beds, the number of obstetrical beds, and the number of births, for each hospital. The Ontario Health Insurance Plan (OHIP) provided data on the number of billings for births, Caesarean sections and epidurals, for each hospital, for the calendar year 1993.

Data analysis

The data were analyzed using Lotus 123 and Epi Info Version 6.02 (USD Inc. Stone Mountain, Georgia, USA). Statistical analysis included the use of chi-squared, with Yates' correction when needed, Kruskal-Wallis one-way ANOVA, least squares regression analysis and Pearson correlation coefficients. To determine the validity of the data, comparisons were made between data from different sources, using correlation coefficients and least squares linear regression: $P < 0.05$ was considered statistically significant.

To study regional variations in obstetrical anaesthesia,

the Province was divided, on the basis of population density, into five areas with roughly equal numbers of hospitals. These were:

Metropolitan Toronto.

The "Golden Horseshoe," the conurbation around Toronto, limited by and including Oshawa, Newmarket, Kitchener-Waterloo, Brantford and Port Colbourne.

Northern Ontario - North of latitude 45°30', which passes north of Parry Sound and Ottawa, but south of Pembroke.

East and West, formed by dividing the remainder of the Province using a line from Newmarket to Georgian Bay at Wasaga Beach.

Results

Response rate

After two reminders, 157 of the 160 hospitals replied. The remaining three hospitals completed the survey by telephone, resulting in a 100% response rate. Eighteen hospitals no longer had active obstetrical beds and were deleted from the study, leaving data from 142 hospitals for further analysis. Some hospitals did not reply to all the questions.

The complete data set is available on disc from the author.

Validity of data

Comparison of the number of births recorded in "Guide to Canadian Health Care Facilities" and the survey produced an r value of 1.00, with a regression slope of 0.98. This demonstrates that the survey data for number of births was accurate. The survey data were often rounded to the nearest 100, so the "Guide" data were used for all further analysis. Comparison of the OHIP data for the epidural rate and the survey data produced an r value of 0.91. The survey was considered the more reliable source, as the calculation of the OHIP rate depended on both the obstetrician and the anaesthetist billing accurately.

The OHIP data were used for the number of Caesarean sections at 23 hospitals and the epidural rate at eight hospitals, which had not completed this part of the survey form.

Numbers for total beds, obstetric beds and births are from the "Guide." All other data are from the survey, except where OHIP data was used because the survey data was incomplete (Table I).

Caesarean section

Thirteen hospitals did not perform Caesarean sections. All 129 hospitals that performed Caesarean sections did some under general anaesthesia, although 14 commented

TABLE I Hospitals in Ontario with obstetric beds

	Total	Mean	SD	Minimum	Median	Maximum
Total beds	28,048	197.5	184.2	10	117.0	1,173
Obstetric beds	2,791	19.7	18.3	1	12.5	82
Births	150,686	1,061.2	1,158.2	3	449.5	4,977
Caesarean sections	25,662	180.7	196.3	0	100.0	1,040
Caesarean rate (%)	N/A	15.6	7.7	0	16.5	38
Epidurals	57,446	404.5	684.9	0	41.8	3,633
Epidural rate (%)	N/A	20.2	23.0	0	10.0	90
Anaesthetists	749	5.3	5.0	0	4.0	30

Data were obtained for all 142 hospitals; Overall epidural rate (total epidurals/total births) = 38.1%; Overall Caesarean section rate (total CS/total births) = 17.0%.

TABLE II Availability of various types of analgesia in labour

Type of analgesia	n	Yes	(%)	No	(%)
<i>im/iv</i> opioids (e.g., meperidine)	140	134	(96%)	6	(4%)
Nitrous oxide (e.g., "Entonox")	142	106	(75%)	36	(25%)
Epidural analgesia	142	106	(75%)	36	(25%)
Transcutaneous electrical nerve stimulation (TENS)	138	72	(52%)	66	(48%)
Patient-controlled analgesia (PCA)	139	14	(10%)	125	(90%)

n = Number of replies.

that general anaesthesia was only used rarely, or for emergencies. Epidural anaesthesia was used in 93% of hospitals, and spinal anaesthesia in 48%. A total of 358 Caesarean sections was performed in the seven hospitals that did not offer the option of a regional anaesthetic technique.

Intramuscular (*im*) or intravenous (*iv*) opioids were used for post-Caesarean analgesia in 99% of hospitals. This was the only form of postoperative analgesia available in 66 hospitals. Patient-controlled analgesia (PCA) was used in 31% of hospitals. Spinal or epidural opioids were used in 28% of the hospitals which used spinal or epidural anaesthesia for Caesarean section.

Analgesia in labour

Opioids were used, *im* or *iv*, in 96% of hospitals (Table II). Nine hospitals commented that they used nalbuphine *im* for analgesia. Nitrous oxide and epidural analgesia were each available in 75% of hospitals. Five hospitals were planning to introduce nitrous oxide. Transcutaneous electrical nerve stimulation (TENS) was used in 52%. Two hospitals had recently stopped using it, and 12 noted that the patient had to supply her own TENS machine. Patient-controlled analgesia was used in labour in 10% of hospitals, with two more planning to start using it. The median number of types of analgesia offered was three (in 49% of hospitals). Three hospitals offered fewer than three choices, and three offered all five. Hospitals without epidurals were more likely to have nitrous oxide than those with epidurals (89% vs 70%, $P < 0.05$).

Of the 106 hospitals which provided epidural analgesia, 96 used infusion pumps. The local anaesthetic used was either bupivacaine (90%) or lidocaine (23%). In 13% of hospitals, both drugs were used. Seventy-six hospitals reported adding an opioid to the infusion. The only opioids used were fentanyl (95%) and morphine (5%). Top-ups were used in 100 hospitals. In 32% of hospitals nurses were allowed to top-up epidurals, and in 29% physicians not trained in anaesthesia could give top-ups.

In 37 hospitals epidurals in labour had not been performed in the previous year. These hospitals had a combined annual total of 6,538 births. Communities as large as Sarnia (population 46,000, 1,310 births) and Chatham (population 42,000, 1,077 births) had no labour epidurals. There were 14 hospitals in which epidurals were available for Caesarean sections, but not for pain relief during labour. There were 4,575 births in these hospitals.

In 16 hospitals the epidural rate was between 0% and 5%, and in a further 15 the rate was between 5% and 10%. At the other extreme, 32 hospitals had an epidural rate of 40% or higher, and 14 had a rate of 60% or higher (Figure). Only 20% of the hospitals in Ontario claim to be able to provide a 24-hr epidural service (Table III). Even where there was an epidural service, the epidural analgesia rate varied enormously. For example, 1/4 of the hospitals with a 24-hr epidural service had an epidural rate of <33%, and 1/4 had an epidural rate of >62%. There was no correlation between the epidural rate and the Caesarean section rate ($r = 0.14$).

TABLE III Availability of epidural analgesia

Availability of labour epidurals	n	Total births	Epidural rate (%)				
			Mean	± SD	Minimum	Median	Maximum
1 Available 24 hr	29	60,502	48.3	20.9	5	50	80
2 Sometimes limited	63	76,227	22.6	18.2	1	18	90
3 Special cases only	14	7,419	3.1	3.1	0	2	10
4 No epidurals	36	6,538	0.0	0.0	0	0	0
	142	150,686	<i>P</i> < 0.0001				

n = Number of hospitals; SD = standard deviation.

TABLE IV Size of hospital, epidural rate and number of anaesthetists

Births per year	n	Mean beds	Epidural rate %		
			Mean	± SD	Anaes.
0-499	73	67.6	5.9	10.3	2.2
500-999	12	232.3	20.9	13.7	5.0
1,000-1,499	13	263.5	23.2	22.2	5.3
1,500-1,999	14	291.7	38.0	23.9	8.4
2,000-2,499	12	357.8	41.1	24.5	9.0
2,500+	18	473.4	47.7	20.1	13.0
<i>P</i>			<0.0001		<0.0001

n = number of hospitals; Mean beds = mean number of beds; SD = standard deviation; Anaes. = mean number of anaesthetists.

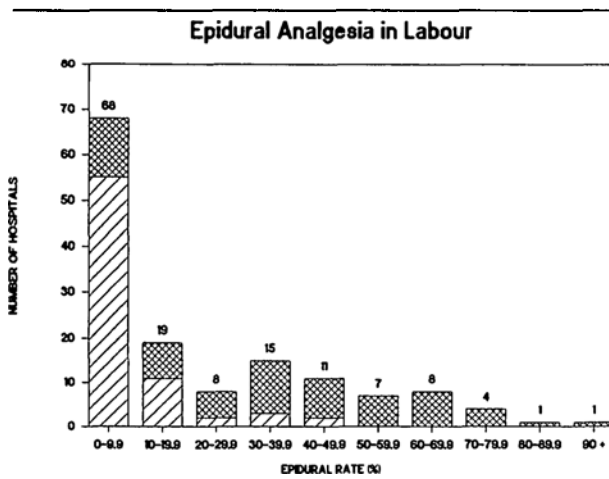


FIGURE Number of hospitals with epidural rates in each range; striped area = hospitals with under 500 births per year; hatched area = all other hospitals; numbers above columns = total number of hospitals in each range.

The epidural rate correlated with the number of anaesthetists ($r = 0.63$), the total number of beds ($r = 0.65$), the number of obstetrical beds ($r = 0.71$), and with the number of births ($r = 0.72$) (Table IV). Therefore, 52% of the variability in the epidural rate is at-

tributable to variability in the number of births. The regression formula is:

$$\text{Epidural rate} = \{0.0142 \times (\text{number of births})\} + 5.0.$$

Even after removing all teaching and referral hospitals, and all hospitals which did not perform epidurals, there was still a correlation between the number of births and the epidural rate ($r = 0.60$).

Over half the hospitals in the study were small (<500 births per year) and had an average epidural rate of 6%. These 73 small hospitals accounted for 20% of all the epidurals in the province. Half of the 57,446 labour epidurals in Ontario were performed in 14 large hospitals.

All hospitals with ten or more anaesthetists did some epidurals. All with 15 or more anaesthetists regularly provided epidural analgesia, and all with >25 anaesthetists provided a 24-hr service (Table V). Thirty hospitals had an anaesthetist in the hospital at night. They were all large hospitals (average 2,748 births and 11.7 anaesthetists), and all provided a 24-hr epidural service. None of the hospitals which did not regularly perform epidurals had an anaesthetist in the hospital at night. There were 13 hospitals with anaesthesia residents. They had an average of 2,938 births and an average epidural rate of 61%, compared with 47% which would be predicted based on the number of births.

TABLE V Number of anaesthetists and availability of epidural analgesia

Anaes.	n	Availability				Epidural Rate %		% Anaes. at night
		1	2	3	4	Mean	±SD	
0-4	82	9	28	10	35	8.6	13.4	1
5-9	38	7	27	3	1	29.0	22.8	32
10-14	13	7	5	1	0	41.1	24.9	62
15+	9	6	3	0	0	57.9	11.5	100
<i>P</i>						<0.0001		

Anaes. = Number of anaesthetists; *n* = number of hospitals; Availability scale: (1 = 24 hr), (2 = some limits), (3 = special cases), (4 = no epidurals); % Anaes. at night = percentage with anaesthetist in hospital at night.

TABLE VI Regional variations in obstetrical anaesthesia

Area	n	Mean births	Mean CS rate (%)	Epidural rate (%)	Over 10%	Anaes.
Toronto	18	2,452	17.0	40.1	94%	10.0
"Golden Horseshoe"	25	1,809	17.5	32.1	84%	7.7
East	30	824	17.0	18.1	57%	5.1
West	38	646	13.4	16.6	32%	3.6
North	31	391	14.5	5.5	27%	2.4
<i>P</i>		<0.0001	NS	<0.0001	<0.0001	<0.0001

n = number of hospitals; Mean births = mean number of births per year; CS = Caesarean section; Over 10% = percentage of hospitals with epidural rate over 10%; Anaes. = mean number of anaesthetists per hospital.

The average hospital size decreased from 2,452 births in Toronto to 391 in the north, reflecting the declining population density (Table VI). The average epidural rate decreased from 40% in Toronto to 6% in the north, closely following the rate predicted by hospital size. The number of anaesthetists per 1,000 births was 4.2 in Toronto and the "Golden Horseshoe," and 6.0 in the rest of the Province.

Discussion

The Canada Health Act states that every Canadian resident is entitled to free, comprehensive, universal and accessible health care, but does not specify which services this includes.⁶ Each hospital and each Department of Anaesthesia is able to decide which services it wishes to provide. The Province of Ontario had a population of 10.9 million in 1994 and an area of 1.1 million km². The population density is 10.2 people per km². Health care is funded by the Ontario Health Insurance Plan. All anaesthetists and epidurals are administered by physicians trained in anaesthesia, who are usually paid on a fee-for-service basis.

The survey was sent to the Head Nurse in Obstetrics, because it was felt that a nursing administrator was more likely to reply than a physician, would have easy access to the statistical data, and would be aware of the clinical practice in the obstetric department. No attempt was

made to determine how commonly each type of anaesthesia or analgesia was used, as it was felt that this would make the survey too complicated and reduce the return rate. The data on the percentage of women who get epidural analgesia in labour may be inaccurate, as many hospitals do not routinely collect this information. However, comparison with the OHIP billing data suggests that it is reasonably accurate. No attempt was made to distinguish between GP and specialist anaesthetists, as epidural analgesia should be within the ability of any anaesthetist caring for obstetric patients.

While most hospitals now provide a choice of general or regional anaesthesia for Caesarean section, 5% perform all sections with general anaesthesia. Although this is considerably less than the 26% reported from British Columbia (in 1986),³ ideally every hospital should be able to provide regional anaesthesia for Caesarean sections. More hospitals should be offering spinal anaesthesia, which is quicker and easier than epidural anaesthesia, and avoids the use of potentially toxic doses of local anaesthetic.⁷

For postoperative analgesia, patients prefer either PCA or epidural morphine to *im* opioids. Epidural morphine produces better postoperative analgesia than *im* opioids.¹ Spinal opioids have been shown to provide safe and effective analgesia after Caesarean section^{8,9} and should be more widely used. For patients undergoing general anaesthesia, PCA should be available.

Intramuscular opioids are not very effective as a method of analgesia in labour, providing 70% of patients with little or no analgesia,^{10,11} but they remain the most widely used treatment. Nitrous oxide is simple, safe, and provides adequate analgesia for 50% of patients,¹⁰ but there are concerns about environmental pollution. It has been suggested that TENS may be no better than a placebo.¹²

Epidural analgesia is safe, has been shown to be the most effective analgesic in labour, and produces the highest patient satisfaction scores.² In one study, epidural analgesia provided complete pain relief to 88% of patients whereas meperidine, Entonox and TENS were unable to provide more than partial analgesia.¹¹ Curiously, there seems to be little public pressure to provide epidural analgesia in labour. Women's groups tend to emphasize natural childbirth and midwifery. The Canadian Council on Health Services Accreditation does not mention epidural analgesia in its standards for obstetric departments.¹³

In Ontario, 75% of hospitals currently provide epidural analgesia to women in labour, compared with 54% in 1982.⁴ Higher availability has been reported in more densely populated areas; 96% in the UK,¹⁴ 85% in Sweden,¹⁵ and 77% in the USA. Lower availability has been found in rural South Australia (71%),¹⁷ in British Columbia (64%),³ and in New Brunswick (60%, author's unpublished observations). The overall epidural rate of 38% is higher than any previously reported. In other studies the overall epidural rate varied from 13% in Sweden¹⁵ to 24% in New Brunswick (author's unpublished observations) and 34% in Ontario in 1982.⁴ This high rate is largely due to a few very large hospitals with very high epidural rates.

Epidural infusions were used by 91% of the hospitals in which labour epidurals were performed, compared with 40% in the UK¹⁴ and 55% in Sweden.¹⁵ The popularity of infusions in Ontario may be due to the publication of guidelines that do not require the anaesthetist to be immediately available during the maintenance of an epidural infusion.¹⁸ In the UK, midwives routinely top-up epidurals. This has been shown to be safe in several large studies, but there have been isolated tragedies.¹⁹ The possibility of a sudden adverse reaction requires that anyone giving a top-up should be adequately trained to deal with any complication. One hopes that the personnel who give top-ups in the 47% of Ontario hospitals that allow people other than anaesthetists to do so are adequately trained. However, since this study was completed, midwives have been allowed to practice independently in Ontario. The practice of midwifery can include the "supervision of epidural analgesia and the administration of top-ups" even though their curriculum contains "no content relating to the clinical principles and the clinical prac-

tice of epidural analgesia."²⁰ This oversight is now being addressed.

The increase in epidural rate with the size of the hospital has been noted in other studies. In the UK the epidural rate for units with fewer than 1,500 births was 12%, compared with 23% in units with more than 3,000 births,¹⁴ and in Sweden the rates for units with fewer than 1,000 births was 6%, compared with 17% in units with more than 2,000 births.¹⁵ This may be related to the availability of an anaesthetist. Large obstetric units often have a designated obstetric anaesthetist on site, which may increase the epidural rate. The busy, impersonal environment of the labour and delivery floor in many larger hospitals may deprive the patient of personal and continuous emotional support, and make epidural analgesia more necessary. Women in labour then come to expect epidurals as part of the hospital routine. The higher epidural rate in larger centres is not due to the complexity of the cases, as the epidural rate for normal pregnancies, attended by family physicians, in three major Toronto teaching hospitals was 59%.²¹ Hospitals with anaesthesia residents had higher epidural rates than hospitals of similar size without anaesthesia residents. While this provides valuable experience for the anaesthesia residents, it means that obstetrical residents get little exposure to women labouring without epidural analgesia. This may not be good training for a career in a hospital with a 5% or 10% epidural rate.

The considerable regional variation in epidural rate from 6% in northern Ontario to 40% in Toronto can be explained on the basis of the size of the hospitals. It is not due to complicated deliveries being moved south to larger centres, as most of these cases would be dealt with in Sudbury, a major referral centre in northern Ontario. The variation in epidural rate is not due to an absolute shortage of anaesthetists, as there are 6.1 anaesthetists per 1,000 births in the north, compared with 4.0 in the Toronto area and 6.0 in the rest of the Province. However, presumably many of the northern anaesthetists are part-time and have many other commitments.

It is not possible to specify an ideal rate for epidural analgesia in labour. The epidural rate should reflect the needs of the labouring population. Multiparous women having short uncomplicated labours in community hospitals are obviously less likely to need epidural analgesia than primiparous patients whose labours are being induced and who have been transferred to a major centre for the management of obstetric complications. The author, who works in a community hospital with a 13% epidural rate, and is aware of some additional patients who would benefit from an epidural, believes that an epidural rate of 15–20% is the lowest acceptable rate, and that a rate of 60% is too high. A British study sug-

gested that 17% was the idea rate,²² and an Australian study suggested 30%.²³

Hospitals that have an epidural rate of <10% are probably not providing epidural analgesia to all those women who would benefit from it. In Ontario, 48% of hospitals fail to meet this target, compared with 16% of hospitals in the UK.¹⁴ The 68 Ontario hospitals with an epidural rate <10% include 12 institutions with five or more anaesthetists and eight with more than 1,000 births per year. In total, they account for over 25,000 births per year. In northern Ontario, 77% of hospitals have an epidural rate of <10%. It is tempting to believe that nothing can be done to improve the epidural rate in small isolated hospitals. However, in rural South Australia all the hospitals with more than 100 births per year provided an epidural service, with an average epidural rate of almost 20%.¹⁷

Is there an excessively high epidural rate in some hospitals? Brownridge²³ suggested that a rate of over 40% was inappropriate. In Ontario, 23% of hospitals have a rate of over 40%, compared with only 4–8% of British hospitals.^{14,22} As epidurals are the most effective analgesic in labour, does it matter if they are over-used? The risks associated with epidurals include death¹⁹ and major permanent neurological deficit,²⁴ although both are very rare. Epidural analgesia is associated with an increased incidence of forceps delivery²⁵ and the long-term consequences of epidural analgesia, such as persistent backache,²⁶ have not been adequately investigated.²⁵ Also, epidural analgesia is the most costly type of analgesia in labour. At Orillia Soldiers' Memorial Hospital a typical epidural infusion costs \$12.12 for drugs, \$50.45 for disposables and \$132.48 for physicians' fees, for a total of \$195.05, compared with \$0.20 for 100 mg meperidine. The total cost of labour epidurals performed in Ontario each year is about \$11 million.

It is curious that so much attention has been paid to relatively minor variations in the rate of Caesarean sections and cardiac surgery,²⁷ while little attention has been paid to much larger variations in the provision of epidural analgesia in labour.

Questions for further research include:

- 1 Do variations in epidural rate reflect medical indications for epidural analgesia, e.g., occiput posterior position, induction of labour?
- 2 Do epidural rates reflect patient needs? Is there a large unmet demand for epidural analgesia, especially in northern Ontario? Are some women pressured into accepting early and perhaps unnecessary epidurals? Does the location of the anaesthetist affect the epidural rate?
- 3 Do variations in epidural rates affect outcome? If similar hospitals, with similar patient populations, have different epidural rates, does this affect the duration

of labour, the forceps rate, the Caesarean section rate or the neonatal outcome?

Recommendations

There are several ways in which obstetrical anaesthesia in Ontario could be improved:

- 1 All anaesthetists who are "on call" for Caesarean sections should perform a regional technique when indicated.
- 2 More attention needs to be paid to analgesia after Caesarean section. All hospitals in which Caesarean sections are performed should offer either PCA or spinal opioids for postoperative analgesia.
- 3 All hospitals with five or more anaesthetists, and all Perinatal Referral Centres, should provide epidural analgesia when necessary.
- 4 Anaesthetists in smaller hospitals should be encouraged and trained to provide epidural analgesia.
- 5 Hospitals with a high epidural rate should consider why so many patients require an expensive and invasive form of analgesia.

Acknowledgements

Thanks go to the nurses who provided me with data, to Mary-Ellen Betteridge at OHIP, to Jeanie Myers for secretarial assistance and data entry, and to Kevin Tasa at the University of Toronto for statistical advice. Also to Meg, Kate, Grant and the Simcoe County Research Group.

Appendix

Obstetrical anaesthesia survey

(A) What methods of providing pain relief in labour are used in this hospital?

- | | |
|--|--------|
| 1 <i>im/iv</i> narcotics (e.g., Demerol) | YES/NO |
| 2 Nitrous oxide ("Entonox") | YES/NO |
| 3 Patient-controlled analgesia (PCA) | YES/NO |
| 4 TENS | YES/NO |
| 5 Epidural analgesia | YES/NO |

If you do not use epidurals please skip to question (F).

(B) Are epidural infusions used? YES/NO

If infusions are used:

- 1 Which local anaesthetic is usually used?
What concentration? %
- 2 Is a narcotic (e.g., fentanyl, epimorph) added?
YES/NO
If so, which one?

(C) If epidural "top-ups" are used:

- | | |
|--|--------|
| Can the nurses give "top-ups"? | YES/NO |
| Can doctors who are not anaesthetists give them? | YES/NO |

- (D) How easy is it for a labouring woman to get an epidural in this hospital? (Circle number beside best response)
- 1 Epidurals freely available around the clock
 - 2 Sometimes limited by availability of anaesthetist
 - 3 Epidurals by special arrangement only
- (E) What percentage of women get epidurals in labour? %
- (F) In this hospital, what types of anaesthetic are used for Caesarean sections?
- 1 General anaesthesia? YES/NO
 - 2 Epidural anaesthesia? YES/NO
 - 3 Spinal (subarachnoid) anaesthesia? YES/NO
- (G) In this hospital, what types of analgesia are used to provide pain relief after Caesarean section?
- 1 *im* or *iv* narcotics? YES/NO
 - 2 Epidural or spinal narcotics? YES/NO
 - 3 Patient-controlled analgesia (PCA)? YES/NO
- (H) Is there an anaesthetist in the hospital at night? YES/NO
- If not, is any doctor in the hospital at night? YES/NO
- (I) Are there anaesthesia residents in the hospital? YES/NO
- (J) 1 How many anaesthetists are on staff?
- 2 How many deliveries are there each year?
 - 3 How many Caesarean Sections?

Thank You! Would you like a copy of my results? YES/NO

References

- 1 Eisenach JC, Grice SC, Dewan DM. Patient-controlled analgesia following cesarean section: a comparison with epidural and intramuscular narcotics. *Anesthesiology* 1988; 68: 444-8.
- 2 Paech MJ. The King Edward Memorial Hospital 1,000 mother survey of methods of pain relief in labour. *Anaesth Intensive Care* 1991; 19: 393-9.
- 3 McMorland GH, Jenkins LC, Douglas MJ. A survey of obstetric anaesthesia practice in British Columbia. *Can Anaesth Soc J* 1986; 33: 185-94.
- 4 Adamson DH, Burton HJ, Heidenheim P. Epidural analgesia in obstetrics: the Ontario experience. Final report. London, Ontario: Department of Anaesthesia, The University of Western Ontario; March 1983.
- 5 Dillman DA. Mail and Telephone Surveys: The Total Design Method. New York: John Wiley & Sons; 1978.
- 6 Canada Health Act. 1984, C. 6, s. 7.
- 7 Brownridge P. Spinal anaesthesia revisited: an evaluation of subarachnoid block in obstetrics. *Anaesth Intensive Care* 1984; 12: 334-42.
- 8 Chadwick HS, Ready LB. Intrathecal and epidural morphine sulfate for postcesarean analgesia - a clinical comparison. *Anesthesiology* 1988; 68: 925-9.
- 9 Writer WDR. Epidural morphine for post-Caesarean analgesia (Editorial). *Can J Anaesth* 1990; 37: 608-12.
- 10 Holdcroft A, Morgan M. An assessment of the analgesic effect in labour of pethidine and 50 per cent nitrous oxide in oxygen (Entonox). *The Journal of Obstetrics and Gynaecology of the British Commonwealth* 1974; 81: 603-7.
- 11 Harrison RF, Shore M, Woods T, Mathews G, Gardiner J, Unwin A. A comparative study of transcutaneous electrical nerve stimulation (TENS), Entonox, pethidine + promazine and lumbar epidural for pain relief in labor. *Acta Obstet Gynecol Scand* 1987; 66: 9-14.
- 12 Harrison RF, Woods T, Shore M, Mathews G, Unwin A. Pain relief in labour using transcutaneous electrical nerve stimulation (TENS). A TENS/TENS placebo controlled study in two parity groups. *Br J Obstet Gynaecol* 1986; 93: 739-46.
- 13 Standards for acute care organizations. A client-centred approach 1995. Canadian Council on Health Services Accreditation, Ottawa, Ontario; 1994.
- 14 Davies MW, Harrison JC, Ryan TDR. Current practice of epidural analgesia during normal labour. A survey of maternity units in the United Kingdom. *Anaesthesia* 1993; 48: 63-5.
- 15 Hanson B, Matouskova-Hanson A. Continuous epidural analgesia for vaginal delivery in Sweden. Report of a nationwide inquiry. *Acta Anaesthesiol Scand* 1985; 29: 712-5.
- 16 Gibbs CP, Krischer J, Peckham BM, Sharp H, Kirschbaum TH. Obstetric anesthesia: a national survey. *Anesthesiology* 1986; 65: 298-306.
- 17 Watts RW. Obstetric epidural services in rural South Australia. *Anaesth Intensive Care* 1992; 20: 345-53.
- 18 Smedstad KG, Doig G, Halpern S, Morley-Forster P, Holmes J, Pearce D. Administration of epidural analgesia for pain relief in labour. OMA Section on anaesthesia guidelines. *Ontario Medical Review* 1992; Nov: 33-4.
- 19 Frank M, Heywood A, MacLeod DM. Survey of the practice of epidural analgesia in a regional sample of obstetric units. *Anaesthesia* 1988; 43: 54-8.
- 20 Byrick R, Halpern S, Kronberg J, Smedstad K. Working relations between anesthetists and midwives (Letter). *Ontario Medical Review* 1995; Feb: 10-12.
- 21 Ruderman J, Carroll JC, Reid AJ, Murray MA. Are physicians changing the way they practise obstetrics? *Can Med Assoc J* 1993; 148: 409-15.
- 22 Hibbard BM, Scott DB. The availability of epidural anaesthesia and analgesia in obstetrics. *Br J Obstet Gynaecol* 1990; 97: 402-5.
- 23 Brownridge P. A three-year study of an obstetrical epidural service with top-up doses administered by midwives. *Anaesth Intensive Care* 1982; 10: 298-308.
- 24 Scott DB, Hibbard BM. Serious non-fatal complications

- associated with extradural block in obstetric practice. *Br J Anaesth* 1990; 64: 537-41.
- 25 *Howell CJ*. Epidural vs non-epidural analgesia in labour. *In*: Enkin MW, Keirse MJNC, Renfrew MJ, Neilson JP (Eds.). Pregnancy and childbirth module. "Cochrane database of systematic reviews". Review No. 03399, 6 May 1994. Published through "Cochrane Updates on Disk," Oxford: Update Software, 1994, Disk Issue 1.
- 26 *MacArthur C, Lewis M, Knox EG, Crawford JS*. Epidural anaesthesia and long term backache after childbirth. *BMJ* 1990; 301: 9-12.
- 27 *Naylor CD, Anderson GM, Goel V (Eds.)*. Patterns of Health Care in Ontario: The ICES Practice Atlas. Ottawa: Canadian Medical Association, 1994.