

Occasional Survey

ICU admissions from an obstetrical hospital

Ian D. Stephens FFARACS

To ascertain the anaesthetic complications requiring post-anaesthetic respiratory support in a large obstetrical hospital, the hospital records of obstetrical patients admitted to an adjacent general intensive care unit (ICU) were studied. Obstetrical patients who required mechanical ventilation following anaesthetic complications were identified and their hospital records reviewed. In a ten-year period there were 61,435 women delivered at the Mater Mothers Hospital (MMH) in Brisbane, Queensland, Australia. Of these 24,161 had an anaesthetic associated with delivery including 7,452 general anaesthetics (GAs) and 16,709 regional anaesthetics (RAs). There were also 3,708 GAs and 17 RAs for procedures other than delivery. During this period there were 126 obstetrical admissions to the ICU. Sixteen were due to anaesthetic complications, twelve followed GA and four followed RA. Complications included anaphylaxis, high block and failure of tracheal intubation. The incidence of a major complication of a GA causing admission to the ICU was 1 in 932 and for RA was 1 in 4177 when these were given for delivery ($P < 0.01$). If a complication requiring ICU admission and mechanical ventilation is used as the criterion of safety it appears that RA is safer than a GA for delivery.

Afin de délimiter les complications anesthésiques requérant un support respiratoire postanesthésique, les dossiers des patientes obstétricales admises à l'unité des soins intensifs généraux (ICU) furent étudiés dans un grand hôpital obstétrical. Les patientes admises dans le département d'obstétrique qui ont nécessité la ventilation mécanique après des complications anesthésiques furent identifiées et leurs dossiers furent revus. Pour une période de dix ans 61 435 femmes ont accouché à la "Mater Mothers Hospital (MMH)" de Brisbane, Queensland, Australie. Parmi celles-ci, 24 161 patientes ont reçu des

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From the Department of Anaesthesia, Mater Public Hospitals, South Brisbane, Queensland 4101, Australia.

Address correspondence to: Dr. I. D. Stephens

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anesthésiques pour l'accouchement incluant 7 452 anesthésies générales (GAs) et 16 709 anesthésies régionales (RAs). On a compté aussi 3 708 GAs et 17 RAs pour des procédures autres que l'accouchement. Pendant cette période, on a compté 126 admissions obstétricales à l'ICU. Seize étaient dues à des complications anesthésiques, 12 postanesthésies générales et quatre postanesthésies régionales. Les complications incluent l'anaphylaxie, un risque élevé et l'impossibilité d'intubation trachéale. L'incidence de complications majeures de l'anesthésie générale provoquant l'admission au ICU était de 1 sur 932 et pour l'anesthésie générale de 1 sur 4 177 quand ces procédures furent administrées lors de l'accouchement ($P < 0.01$). Si l'admission à l'ICU et la ventilation mécanique est utilisée comme critère de sécurité, il apparaît que l'anesthésie régionale est plus sécuritaire que l'anesthésie générale pour l'accouchement.

Provision of anaesthetic services is an important part of modern obstetrical practice. Inevitably, this results in a number of patients suffering from complications of obstetrical anaesthesia which may cause them to require post-anaesthetic respiratory support.

To ascertain what kinds of complications occurred in a large obstetrical population the records of a general ICU were studied to find obstetrical patients. Those who were admitted for respiratory support following complications of anaesthesia were then identified and their records reviewed to ascertain their problems and outcome.

Methods

Obstetrical admissions to the ICU at the Mater adult Hospital (MAH) from the MMH were identified in a ten-year period from June 1979 when the ICU was established. The obstetrical patient was defined as any patient who was pregnant or up to one month postpartum. Those patients in this group who were admitted for treatment of anaesthetic complications requiring post-operative mechanical ventilation were identified and their hospital records were reviewed to determine their problems and management.

The MMH is a tertiary referral obstetrical hospital that is connected by a covered walkway to the MAH where the

TABLE I Anaesthetic for delivery at the MMH

Anaesthetic	Delivery		Total
	CS	Vaginal	
GA	7,425	27	7,452
RA EB	4,090	12,597	16,687
SA	22	0	22
Total	11,537	12,624	24,161

EB: Epidural block-caudal. SA: Spinal anaesthesia.

ICU is situated. This facilitates easy transfer of patients. The hospitals practise within the Catholic ethos and some operations concerning fertility are not performed. All the anaesthetics in the MMH are given by trained anaesthetists or anaesthetists-in-training.

In the ten-year period 61,435 women were delivered at the MMH. Table I shows the type of anaesthetics used for delivery. The total number of additional injections through a previously inserted epidural catheter is not known. There were also 3725 anaesthetics given for procedures other than delivery, 3708 were GAs and 17 were caudal epidural blocks (EBs).

Since 1983, all patients at the MMH have received 0.3 M sodium citrate, 30 ml, within 30 min of anaesthesia. Before 1983, 30 ml of mist. mag. trisil was used. No other drugs were used routinely, either as premedication or in labour, to reduce gastric contents and increase gastric pH. In addition, no active physical measures were taken to reduce gastric volumes.

For a GA the patient received preoxygenation if possible. Induction of anaesthesia was with thiopentone and succinylcholine was used to facilitate rapid tracheal intubation as an assistant applied cricoid pressure. The lungs of the patient were ventilated with a 50% mixture of oxygen in nitrous oxide with a volatile anaesthetic agent. At delivery, narcotics were often administered. Muscle relaxation was provided by a non-depolarizing neuromuscular blocking agent which was reversed at the end of the anaesthetic with neostigmine with atropine.

Good *iv* access was established before EB was performed and patients were given between one and two L of lactated Ringer's solution. A loss of resistance technique was used to find the epidural space at the level of an interspace between the second and fifth lumbar vertebrae. A bullet-tipped catheter was inserted into the epidural space and after negative aspiration for blood the cerebrospinal fluid (CSF) injections were made through it.

In labour 2 ml of preservative-free 0.25% bupivacaine plain was injected as a test dose followed five minutes later by increments of 0.25% bupivacaine until satisfactory analgesia was obtained.

TABLE II Causes of obstetrical admission to the ICU

	n	%
Hypertensive disease of pregnancy	30	23.8
Haemorrhage	28	22.2
Anaesthesia	16	12.7
Infection	12	9.5
Heart disease	6	4.8
Musculo skeletal disease	5	4.0
Morbid obesity	5	4.0
Pulmonary embolism	5	4.0
Miscellaneous	19	15.0
Total	126	100.00

TABLE III Reasons for admission to the ICU for complications of anaesthesia

Patient #	Problem	n
5	Allergy/anaphylaxis	5
6-8	"Total spinal"	3
9-10	Succinylcholine apnoea	2
11-12	Failure of tracheal intubation with tracheostomy	2
13	Stridor following extubation	1
14	Unnoticed ventilator disconnection during GA	1
15	Suspected aspiration	1
16	Delay in waking after GA	1

For Caesarean section (CS) before 1987, preservative-free 0.5% bupivacaine plain was used for the EB. Since then a solution has been made up from 18 ml of 2% lidocaine with epinephrine 1:200,000 and two ml of 0.005% fentanyl. The resulting mixture consists of 1.8% lidocaine and 0.0005% fentanyl in epinephrine 1:222,222. It has 9 mg of sodium metabisulphite as preservative. For both solutions 2 ml were injected as a test dose followed five minutes later by injection over 15 min of enough solution to provide anaesthesia to the level of at least the sixth thoracic dermatome.

The criterion for admission of anaesthetic patients to the ICU was that they required continued respiratory support including mechanical pulmonary ventilation. Facilities and staff to manage patients during IPPV are not available at the MMH and no patients requiring ventilation after surgery could stay there. Hence all patients in the hospital requiring pulmonary ventilation after an anaesthetic complication in this ten-year period are included in this series. The anaesthetist responsible for the anaesthetic decided on admission to the ICU in consultation with the ICU director.

Results

During the ten-year period there were no direct maternal deaths at the MMH. There were 126 admissions of 118

TABLE IV Details of patients presenting with allergy

Patient #	Indication for anaesthesia	Anaesthetic	Presentation	Agents used
1	Postpartum uterine curette	GA	Anaphylaxis	Thiopentone Succinylcholine Atropine Fentanyl
2	CS	GA	Anaphylaxis	Thiopentone Succinylcholine d-tubocurarine
3	Labour pain	EB	Anaphylaxis	Bupivacaine
4	CS	GA	Bronchospasm	Thiopentone Succinylcholine Atracurium
5	CS	GA	Anaphylaxis	Thiopentone Succinylcholine

TABLE V Patients with high regional anaesthesia

Patient #	Indication for anaesthesia	Anaesthetic	Drug	Concentration	Volume (ml)
6	Labour pain	EB	Bupivacaine	0.25%	10
7	CS	EB	Lidocaine Epinephrine Fentanyl	1.8% 1:222,222 0.0005%	20
8	CS	SA	Dibucaine	0.5%	1.5

obstetrical patients to the ICU. The major reasons for admission are shown in Table II. One of the 126 patients died of tuberculous meningitis. Complications of anaesthesia accounted for 16 of these admissions (Table III). Within the anaesthetic group all the mothers and their infants survived in good condition. None was admitted more than once.

Patient #14 was admitted to the ICU following an incident in another hospital. All other patients in the series were delivered at the MMH.

Twelve of the ICU admissions were for complications of GA and four for complications of RA.

In the GA group three patients had an anaesthetic for postpartum evacuation of placental tissue, eight for delivery at the MMH and one for delivery elsewhere. All the patients in the RA group had an anaesthetic for delivery at the MMH.

Allergy

Of the five patients who had a major allergic reaction four had GA and one EB (Table IV). Those shown as presenting with anaphylaxis had a syndrome of hypotension, oedema and bronchospasm immediately after

administration of the agents shown. They were all resuscitated with *iv* fluids and epinephrine.

Patient #3 received bupivacaine in an EB for relief of labour pain. She had previously denied anaesthetic problems but later admitted to a similar episode following bupivacaine given for an EB in a previous pregnancy.

High RA

Three patients received a RA which resulted in a high block such that they required ventilatory support for a period of three hours (Table V). They also required intravenous fluid and inotropic support of the circulation.

Patient #6 had 2 ml 0.25% bupivacaine injected through an epidural catheter after negative aspiration for blood and CSF. When this had no measurable effect five minutes later another 8 ml of 0.25% bupivacaine were added. The result was a rapidly ascending block. Later, CSF could be aspirated from the catheter. After initial recovery she developed persistent paraesthesia in her lower limbs for six months which was diagnosed as a transverse myelitis. It resolved without treatment.

Patient #7 had 2 ml of a mixture of 1.8% lidocaine and 0.0005% fentanyl in epinephrine 1:222,222 injected

through an epidural catheter after negative aspiration for blood and CSF. When this had no measurable effect in five minutes a further 18 ml were injected over ten minutes. She rapidly developed a high block. After this, CSF could be aspirated freely from the catheter.

From the patient records it is not possible to postulate why patient #8 had a high block.

Prolonged paralysis

Patients #9 and #10 who had GA for manual removal of the placenta had a prolonged neuromuscular blockade because of abnormal plasma cholinesterase. Patient #9 was homozygous for the silent gene and patient #10 for the dibucaine resistant gene.

Airway obstruction

Two patients required emergency tracheostomy after their tracheas could not be intubated nor their lungs ventilated after induction of GA for CS. It was impossible to intubate the trachea of patient #11 because tonsillar tissue obscured her larynx completely. Attempts to ventilate her lungs failed and she became cyanosed. The obstetrician performed a tracheostomy and she rapidly responded to oxygenation. When the airway was controlled from the tracheostomy, a gum elastic bougie was introduced blindly through her larynx and an endotracheal tube was passed over it. The tracheostomy was closed immediately after surgery and the endotracheal tube removed 24 hr later.

Patient #12 was a woman of very small stature who had been diagnosed as achondroplastic although she lacked many of the features of this syndrome. She presented to the hospital at 32 wk of gestation with marked oedema due to pre-eclampsia. Laryngoscopy after induction of anaesthesia revealed a small and oedematous larynx and initially it was impossible to intubate the trachea or ventilate the lungs. Finally, a 3.5 mm tracheal tube was lodged in her larynx and ventilation through this resulted in an oxygen saturation of 60%. At this point the infant was delivered and was found to be severely hypoxic and acidotic (cord venous pH of 6.8). The mother's condition continued to deteriorate despite ventilation with 100% oxygen. An oto-laryngologist succeeded in opening a tracheostomy through which a five mm tracheostomy tube was passed. Both infant and mother are neurologically intact although the baby suffered from bronchopulmonary dysplasia, which was slow to resolve and has inherited his mother's dyschondroplasia.

Patient #13 had severe pre-eclampsia and had GA for CS at 33 wk of pregnancy. Following tracheal extubation she developed airway obstruction due to oedema and required reintubation of her trachea.

Disconnection from ventilator

Patient #14 became disconnected from the ventilator during GA for CS. The anaesthetist had been called to help to resuscitate the baby and was called back to the patient because the obstetrician noted that she was cyanosed and bradycardic. She was resuscitated and made a slow but complete recovery.

Suspected aspiration

Patient #15 was suspected of aspiration based on the anaesthetist's view of the pharynx and larynx on tracheal intubation. Bronchoscopy was performed in the ICU. No evidence of aspiration was found on bronchoscopy and she did not develop symptoms.

Delay in awakening after GA

Patient #16 was admitted to the ICU for delay in waking from GA. She suffered from congenital hypoparathyroidism but it was impossible to determine from her hospital record the cause of this delay. The lungs were ventilated for 24 hr and then she awoke without difficulty.

Discussion

In a ten-year period 16 obstetrical patients were admitted to a general ICU following anaesthetic problems which required postoperative respiratory support.

Our current policy is only to skin test those patients suspected of anaphylactic reactions although further testing has been recommended.¹ Only two of the three patients tested positive to the drugs given when challenged. The incidence of severe allergy to anaesthetic agents in pregnancy is unknown although it has been described as extremely rare.² Despite the use of a test dose and the routine slow and cautious injection of LA, two "total spinal" occurred following EB due to injection into the subarachnoid space.³ Failure to treat hypoventilation after CS has been reported as a cause of maternal death.^{4,5} Anaesthesia may contribute to hypoventilation or failure of ventilation although other factors may also contribute.⁶ Whether the cause is peripheral (patients #9 and #10) or central (patient #16) the proper management is support of ventilation in the ICU until a diagnosis is made and appropriate treatment given.

Discussions of obstetrical anaesthetic mortality and its prevention have emphasised airway control.⁷ The incidence of failure to intubate the trachea for GA for delivery at the MMH is unknown but is likely to be close to the one in 500 previously suggested.⁸ The incidence of emergency tracheostomy following GA for delivery at the MMH is 1 in 3726. A failed intubation drill is essential for the proper conduct of obstetrical anaesthesia.⁹ Nevertheless no drill can totally prepare the anaesthetist for complete

TABLE VI Complication rates

	<i>Number of complications</i>	<i>Number of anaesthetics</i>	<i>Rate per 10,000</i>
GA	8	7452	10.7*
RA	4	16709	2.4*
Total	12	24161	5.0

*Significant difference $\chi^2 P < 0.05$.

failure to secure an airway. An appreciation that the situation is dangerous and early decisive action are the only ways to save the patient although definitive advice about what to do is not possible.¹⁰ Neither commercial kits enabling the trachea to be entered through the cricothyroid membrane nor laryngeal mask airways¹¹ were available at the time the two patients described here were anaesthetised. These devices could have helped to secure the airway in patient #11.

Laryngeal oedema with airway obstruction is an uncommon but recognised complication of pre-eclampsia. Untreated it may be fatal.¹² The treatment is airway support until the oedema subsides.

In view of the experience of patient #14 the anaesthetist should not have the dual responsibility of resuscitating the newborn and anaesthetizing the mother.

Aspiration of gastric contents is emphasised in obstetric anaesthetic mortality reports.^{4,5} The frequency of aspiration of gastric contents in a hospital is unknown but no patient has aspirated and developed symptoms of severe aspiration requiring ventilatory support in 7,452 GAs for delivery. Fourteen cases of "vomiting or aspiration" were reported following 9,993 obstetrical anaesthetic procedures including about 1400 GAs for CS. No other airway problems were recorded in this report nor was the treatment, if any, that these patients received.¹³

Apart from four patients who had allergic reactions and the two who had succinylcholine apnoea there were avoidable factors in the anaesthetic management of the other patients in this series.

The relative safety of GA versus RA in obstetrics has been the subject of debate.¹⁴ In Australia, the consensus is that RA is safer. The authors of the penultimate report on maternal deaths in Australia said, "The message is loud and clear: General anaesthesia in obstetrics is a real hazard. If possible it should be avoided."¹⁵ The proportion of GAs for CS at the MMH decreased from 85% in 1979 to 44% in 1989 and reflected this opinion. However, in mortality reports the total number of anaesthetics given to obstetrical patients is not known so that the relative safety of the two methods remains unknown.

At the MMH the incidence of a major complication of

anaesthesia for delivery requiring admission to the ICU is 10.7 per 10,000 deliveries following a GA and 2.4 per following a RA (Table VI). ($P < 0.05$). If the need for post anaesthetic respiratory support is used as a criterion, then RA was safer than GA.

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