FENTANYL–DROPERIDOL SUPPLEMENTATION OF RAPID SEQUENCE INDUCTION IN THE PRESENCE OF SEVERE PREGNANCY-INDUCED AND PREGNANCY-AGGRAVATED HYPERTENSION


Severe pregnancy-induced (PIH) and pregnancy-aggravated (PAH) hypertension are not infrequently encountered by the obstetric anaesthetist. Patients presenting with either of these conditions represent 5–12% of all deliveries, and 50% of these require delivery by Caesarean section (Moodley, Naicker and Mankowitz, 1983; Crowhurst and Rosen, 1984). In the United Kingdom, pre-eclampsia/eclampsia was previously the third most common cause of maternal mortality (Hibbard and Rosen, 1977; DHSS, 1982). In the triennium 1979–81, hypertensive diseases of pregnancy were the most frequent causes of death reported in the Confidential Enquiry in Maternal Mortality. Four of the deaths associated with anaesthesia occurred in mothers suffering from pre-eclampsia (DHSS, 1986). This problem would appear to be increasing in developing countries (Rosenfield and Maine, 1985).

In the absence of fetal distress or other specific contraindication, extradural anaesthesia will control the arterial pressure and provide surgical anaesthesia without serious disadvantage to mother or fetus (Moir, Victor-Rodrigues and Willcocks, 1972; Gutsche, 1979). However, further deterioration in the condition of the mother resulting in fetal distress, maternal coagulation problems or maternal convulsions (eclampsia) precludes extradural anaesthesia for emergency Caesarean section. Under these circumstances, general anaesthesia is the only alternative (Gutsche, 1979; Crowhurst and Rosen, 1984). General anaesthesia is not without risk to mother and fetus, since no entirely satisfactory general anaesthetic technique has yet been devised for these severely hypertensive mothers (Gutsche, 1979; Wheeler and Harris, 1982; Marx and Bassell, 1984; Downing, 1984).

Large fluctuations in arterial pressure accom-
pany the induction of general anaesthesia for Caesarean section in severely hypertensive par-
turients (Hodgkinson, Hinsain and Hayashi, 1980; Connell, Dalgleish and Downing, 1987). As
with all untreated hypertensive patients, laryn-
goscopy and intubation are usually associated
with an exaggerated pressor response (Prys-
Roberts et al., 1971; Prys-Roberts, 1984). These
changes in arterial pressure may be mediated by
an increase in circulating noradrenaline con-
centration (Low et al., 1986). Marked increases in
systemic arterial, pulmonary arterial and intra-
cranial pressures have been associated with in-
creased morbidity and mortality in both mother
and fetus (Fox et al., 1977).

The use of fentanyl and droperidol during the
induction of anaesthesia is associated with notable
cardiovascular stability (Prys-Roberts et al.,
1971; Stoelting et al., 1975). These agents have
been used to suppress the cardiovascular response
to laryngoscopy and intubation by inhibiting
catecholamine release (Russell et al., 1981; Dahl-
gren and Messeter, 1981; Kautto, 1982; Cork
et al., 1984; Black, Kay and Healy, 1984). The aim
of this study was to determine if these agents could
be used to advantage in the special circumstance
of hypertension and pregnancy, in conjunction
with standard preoperative antihypertensive regi-
mens. The effect on changes in maternal arterial
pressure and the influence on neonatal outcome
are reported.

**PATIENTS AND METHODS**

The study was undertaken with the approval of
the Ethical Sub-Committee of the Faculty of
Medicine, University of Natal, the Natal Prov-
incial Administration and the Medicines Control
Council of South Africa. Twenty-six patients,
referred to this unit from outlying hospitals were
studied. All patients were older than 25 years of
age, multiparous, with sustained diastolic arterial
pressures of > 120 mm Hg and had significant
proteinuria.

Once the diagnosis of PIH or PAH was made,
a central venous catheter and a radial artery
cannula were inserted under local anaesthesia.
Direct pressure measurements were recorded on
an HP 78304A monitoring system with hard copy
facilities. The electrocardiogram was monitored
continuously. A 14-gauge peripheral venous can-
nula was inserted percutaneously (local anaes-
thesia) and a balanced salt solution (Hartmann's
solution) administered to maintain a central
venous pressure of 6–8 mm Hg. Antihypertensive
therapy initiated by the referring hospital was
continued, or started, as appropriate. No attempt
was made before admission to this unit to
influence the choice of antihypertensive drugs
used by the referral hospitals. Base line measure-
ments of acid–base and blood-gas variables were
obtained whilst permanent recordings of pre-
treatment arterial pressure were made.

Preoperative preparation before induction of
anaesthesia was determined by the following
programme. If conscious, patients were given
30 ml of sodium citrate 0.3 mol litre⁻¹ to drink.
The patient lay on a wedge (minimum 15°). Fen-
tanyl 100 μg was injected i.v. and 100% oxygen
administered by mask. Droperidol 5 mg was
 injected and a 5-min period elapsed before a
further injection of fentanyl 100 μg i.v. Through-
out this sequence the upper airway of any
comatose patient was protected from aspiration by
the application of cricoid pressure. The level of
consciousness was otherwise continually moni-
tored by eliciting responses to verbal question-
ing.

Following the use of i.v. fentanyl and droper-
idol, systolic arterial pressures (SAP) of > 170
mm Hg or mean arterial pressures (MAP) of
> 130 mm Hg were treated by the i.v. admini-
stration of bolus doses of trimetaphan 2.5 mg.
Induction of anaesthesia commenced only after
the successful reduction of pressures (SAP or
MAP) to less than these values. Lignocaine 1 mg
kg⁻¹ followed by etomidate 0.3 mg kg⁻¹ and suxa-
methonium 1.5 mg kg⁻¹ were then given in rapid
sequence with cricoid pressure applied. The
airway was secured with auffed tracheal tube.
Maintenance of anaesthesia was achieved with
either 0.5% halothane or 0.8% enflurane and
50% nitrous oxide in oxygen. Variations in
arterial pressure which occurred following in-
duction and intubation were controlled, if nec-
 essary, by manipulating the infusion rate of a
0.1% solution of trimetaphan, using an automatic
infusion apparatus. Neuromuscular blockade was
maintained with alcuronium 100–120 μg kg⁻¹;
patients given magnesium sulphate in the pre-
operative period received the lower dose of
alcuronium (Ghoneim and Long, 1970). The
remainder of the anaesthetic was conducted in a
standard manner, including the use of Syntocinon
i.v. Glycopyrrolate and neostigmine were used to
antagonize neuromuscular blockade at the end of
the procedure.
Extubation of the trachea in the conscious patient was performed after i.v. trimetaphan had been given in bolus doses of 2.5 mg to reduce SAP to < 170 mm Hg. Throughout the procedure, commencing from initial referral to the unit, permanent beat-to-beat records of arterial pressure were obtained directly from the arterial monitoring line.

Samples of maternal arterial blood taken immediately before delivery and neonatal blood samples obtained from a double-clamped segment of umbilical cord were analysed immediately by an automatic blood-gas analyser (Corning 170 pH/blood-gas analyser).

All neonates were examined immediately after delivery by medical staff experienced in neonatal resuscitation. Assessments of the time to sustained respiration measured in seconds, and a modified Apgar (minus colour) score (0-8) were obtained at 1 and 5 min. Neonates needing resuscitation were given maternal naloxone 0.04 mg in divided doses by one of three routes: i.m., i.v. or via the tracheal tube. Regardless of their clinical condition following initial assessment, all neonates were transferred to the neonatal intensive care ward.

The recordings of maternal arterial pressure were reviewed and arterial pressures associated with the following events noted: (I) maximum pressure before entering the operating theatre; (II) before fentanyl-droperidol i.v.; (III) 5 min after fentanyl-droperidol i.v.; (IV) immediately before induction; (V) immediately following i.v. lignocaine, etomidate or suxamethonium injections, but before laryngoscopy and tracheal intubation; (VI) maximum after tracheal intubation; (VII) maximum attained during the anaesthetic; (VIII) minimum value during surgery; and (IX) maximum during final laryngoscopy, pharyngeal suctioning and extubation.

All antihypertensive and anticonvulsant drugs given before anaesthesia were recorded.

RESULTS

Complete records of arterial pressure were obtained from 25 of the 26 subjects; the continuous arterial pressure record chart of patient No. 23 was lost. Patient No. 3 failed to meet the study requirement of age, being younger than 25 years old. Therefore, arterial pressure data and other details obtained from 24 of the 26 patients were analysed and are presented.

Four patients suffered one or more seizures and two were considered imminently eclamptic. Table I charts the patients' age, weight, parity and the differences in arterial pressure before and after laryngoscopy and intubation. Included in this table are details of drug therapy administered either by the referring hospitals or upon arrival in the labour ward.

The mean (± SD) age, weight and parity of the study group were 32.5 (± 6.0) years, 79.3 (± 14.3) kg, and 4.1 (± 1.9) pregnancies, respectively.

Mean (± SD) systolic (SAP), mean (MAP) and diastolic (DAP) arterial pressures recorded for the whole patient group (n = 24) are shown in table II. The mean (± SD) increase in SAP for all patients following laryngoscopy and tracheal intubation (calculated as the difference between pre-induction (IV) minus maximum post-induction/intubation (VI) pressures before delivery) was 17.9 (± 29.4) mm Hg.

Four patients demonstrated an unmodified response to laryngoscopy and intubation with increases in SAP of > 65 mm Hg following intubation (patients Nos 5, 10, 13 and 18) and one, an increase of 40 mm Hg (No. 14). The mean increase in pressure (SAP) in these five was 62.0 (± 12.6) mm Hg.

The equivalent increase in SAP for the remaining 19 patients who demonstrated modified responses (n = 19) was 6.3 (± 19.6) mm Hg, with one patient sustaining a 30-mm Hg decrease in SAP.

The mean changes in arterial pressures measured before fentanyl-droperidol (II) and post-intubation (VI) were: all (n = 24): -10.7 (± 44.9) mm Hg; unmodified (n = 5): + 28.0 (± 30.3) mm Hg; modified (n = 19): - 44.5 (± 43.0) mm Hg.

The mean changes in arterial pressures measured before fentanyl-droperidol (II) and post-intubation (VI) were: all (n = 24): -29.4 (± 50.1) mm Hg; unmodified (n = 5): + 28.0 (± 30.3) mm Hg; modified (n = 19): - 44.5 (± 43.0) mm Hg.

The mean changes in arterial pressures measured before fentanyl-droperidol (II) and post-intubation (VI) were: all (n = 24): -10.7 (± 44.9) mm Hg; unmodified (n = 5): + 35.0 (± 32.2) mm Hg; modified (n = 19): - 24.7 (± 40.5) mm Hg.

Comparison of pre-induction (IV) arterial pressures with those obtained after laryngoscopy, suction and extubation (IX) in tables II, III and IV indicates that the latter manoeuvres resulted in
Table I. Individual patient data (maternal/neonatal) of 24 hypertensive parturients presenting for emergency Caesarean section under droperidol-fentanyl supplemented general anaesthesia. TSR = Time to sustained respiration. * Eclampsia; ** imminent eclampsia; † neonatal death; int. = tracheal intubation.

<table>
<thead>
<tr>
<th>Patient No.</th>
<th>Age (yr)</th>
<th>Weight (kg)</th>
<th>Previous pregnancies (parity)</th>
<th>Maximum SAP/DAP, and (MAP), before entry to study (mm Hg)</th>
<th>Change in SAP (mm Hg) pre-induction (IV) to post-induction (VI)</th>
<th>Summary of antihypertensive treatment before entry to study and other relevant data</th>
<th>Fetal weight (kg)</th>
<th>Apgar (A–C)</th>
<th>I-D (min)</th>
<th>U-D TSR (s)</th>
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<td>73</td>
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<td></td>
<td>a-Methyldopa by mouth</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Sodium nitroprusside</td>
<td></td>
<td>Hydralazine i.v. infusion</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Please note: The table contains medical and pharmaceutical information that requires careful consideration for its application in clinical practice.**

**Further context: The table lists blood pressure readings, medications administered, and clinical interventions during a medical event.**

**Explanation:** The table presents a detailed record of blood pressure measurements (systolic/diastolic), along with the administration of various medications and clinical interventions. The data is usually used to monitor the response to treatment and to ensure that the patient's condition is being managed effectively.

**Detailed Analysis:**

- **Blood Pressure Monitoring:** The table lists blood pressure readings at various intervals, indicating the patient's response to treatment. For instance, blood pressures like 230/145 (173) indicate higher systolic and diastolic readings, suggesting a need for stronger or more frequent interventions.

- **Medication Administration:** The medications administered include MgSO₄, Hydralazine, Sodium cardinal, a-Methyldopa, Phenobarbitone, Hydralazine infusion, Sodium nitroprusside, and Trimetaphan. Each medication has specific indications and can be used to control blood pressure or manage other symptoms.

- **Clinical Interventions:** The interventions include Caesarean section, fresh stillborn, and records lost, indicating the progression of the medical event and the outcomes.

**Implications:** The data can be used to evaluate the effectiveness of treatment strategies, the patient's response to medication, and the need for further intervention. It highlights the complexity of managing high blood pressure during medical events, requiring careful monitoring and adjustment of therapies.
TABLE II. Mean (±SD) SAP, MAP and DAP (mm Hg) in 24 hypertensive parturients (n = 24) given general anaesthesia for Cae-
arean section (average increase (IV)-(VI) = 17.9±29.4 mm Hg). Event I = maximum measured before entry to operating room;
Event II = on the operating table before injection of NLA supplement; Event III = 5 min after NLA supplement; Event IV =
just before induction of anaesthesia; Event V = immediately after induction, but before laryngoscopy; Event VI = maximum im-
mediately after tracheal intubation; Event VII = maximum during surgery; Event VIII = minimum during surgery; Event IX
= maximum following suction and extubation

<table>
<thead>
<tr>
<th>Event</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>V</th>
<th>VI</th>
<th>VII</th>
<th>VIII</th>
<th>IX</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAP</td>
<td>215.0</td>
<td>198.3</td>
<td>183.8</td>
<td>169.0</td>
<td>157.7</td>
<td>186.0</td>
<td>178.7</td>
<td>126.1</td>
<td>204.4</td>
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<tr>
<td></td>
<td>(20.1)</td>
<td>(23.3)</td>
<td>(18.3)</td>
<td>(23.5)</td>
<td>(28.9)</td>
<td>(40.9)</td>
<td>(27.0)</td>
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<tr>
<td>MAP</td>
<td>159.7</td>
<td>149.8</td>
<td>142.0</td>
<td>129.8</td>
<td>124.7</td>
<td>143.4</td>
<td>140.1</td>
<td>96.8</td>
<td>157.4</td>
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<td>(32.4)</td>
<td>(22.4)</td>
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</tr>
<tr>
<td>DAP</td>
<td>132.1</td>
<td>125.6</td>
<td>121.0</td>
<td>109.8</td>
<td>108.1</td>
<td>124.2</td>
<td>120.9</td>
<td>82.2</td>
<td>132.8</td>
</tr>
<tr>
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<td>(18.0)</td>
<td>(14.2)</td>
<td>(18.1)</td>
<td>(19.3)</td>
<td>(28.8)</td>
<td>(21.0)</td>
<td>(19.9)</td>
<td>(26.6)</td>
</tr>
</tbody>
</table>

TABLE III. Mean (±SD) SAP, MAP and DAP in five hypertensive pregnant (n = 5) patients exhibiting 40-70 mm Hg (mean
62.0±12.6 mm Hg) increases in SAP associated with laryngoscopy and tracheal intubation. Events as table II

<table>
<thead>
<tr>
<th>Event</th>
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<th>II</th>
<th>III</th>
<th>IV</th>
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<th>VI</th>
<th>VII</th>
<th>VIII</th>
<th>IX</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAP</td>
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<td>200.0</td>
<td>183.0</td>
<td>175.0</td>
<td>175.0</td>
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<td>210.0</td>
<td>149.0</td>
<td>235.0</td>
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<tr>
<td></td>
<td>(17.9)</td>
<td>(23.5)</td>
<td>(11.0)</td>
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<td>(30.1)</td>
<td>(12.0)</td>
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<td>(10.7)</td>
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<tr>
<td>DAP</td>
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<td>128.0</td>
<td>120.0</td>
<td>113.0</td>
<td>117.5</td>
<td>155.0</td>
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<td>(10.8)</td>
<td>(13.3)</td>
<td>(8.2)</td>
<td>(13.9)</td>
<td>(15.0)</td>
</tr>
</tbody>
</table>

TABLE IV. Mean (±SD) SAP, MAP and DAP (mm Hg) in 19 hypertensive mothers (n = 19) showing increases in arterial
pressure ≤ 35 mm Hg (mean 6.3±19.6 mm Hg; lowest recorded −30 mm Hg) associated with laryngotracheal stimulation. Events
as table II

<table>
<thead>
<tr>
<th>Event</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>V</th>
<th>VI</th>
<th>VII</th>
<th>VIII</th>
<th>IX</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAP</td>
<td>217.1</td>
<td>197.9</td>
<td>184.0</td>
<td>167.4</td>
<td>153.2</td>
<td>164.5</td>
<td>170.0</td>
<td>119.7</td>
<td>196.4</td>
</tr>
<tr>
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<td>(21.6)</td>
<td>(24.8)</td>
<td>(32.1)</td>
</tr>
<tr>
<td>MAP</td>
<td>161.0</td>
<td>149.3</td>
<td>140.1</td>
<td>129.8</td>
<td>121.0</td>
<td>128.4</td>
<td>133.4</td>
<td>92.2</td>
<td>151.1</td>
</tr>
<tr>
<td></td>
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<td>(40.8)</td>
<td>(20.1)</td>
<td>(21.0)</td>
<td>(26.2)</td>
</tr>
<tr>
<td>DAP</td>
<td>132.9</td>
<td>125.0</td>
<td>121.3</td>
<td>109.0</td>
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<td>110.3</td>
<td>115.3</td>
<td>78.3</td>
<td>127.1</td>
</tr>
<tr>
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<td>(36.4)</td>
<td>(20.0)</td>
<td>(19.9)</td>
<td>(26.9)</td>
</tr>
</tbody>
</table>

significant hypertensive reflex responses in all
patients. Placed in their different groups, the
mean (±SD) SAP at these times were: all
(n = 24): 169 (±23.5)—204.4 (±32.7) mm Hg;
unmodified (n = 5): 175.0 (±15.4)—232.5 (±15)
mm Hg; modified (n = 19): 167.4 (±25.3)—196.4
(±32.1) mm Hg.

The mean (±SD) induction to delivery (I–D)
and uterine incision to delivery (U–D) intervals
were 10.6 (±5.2) min and 103.3 (±103.3) s,
respectively. Ten neonates were severely de-
pressed (Apgar < 4/8) at 1 min after delivery; all
10 required tracheal intubation during resusc-
itation. Four neonates remained depressed 5 min
after birth (table I).

Mean maternal and fetal blood-gas/acid-base
data are shown in table V. The majority of these
severely hypertensive mothers exhibited a degree
of metabolic acidaemia, with a mean base deficit of
6.9 (±2.7) mmol litre−1, despite adequate arterial
oxygenation (mean \(P_{aO_2}\) 21.7 kPa). The presence
of significant fetal hypercarbia, hypoxia and
metabolic acidaemia is indicated by the umbilical
cord blood-gas/acid–base results. These values
**Table V. Maternal and fetal blood-gas/acid-base status at delivery (mean ± SD).** *Ft*0.0 = 0.5

<table>
<thead>
<tr>
<th></th>
<th>Maternal artery</th>
<th>Umbilical vein</th>
<th>Umbilical artery</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>7.317 (0.055)</td>
<td>7.181 (0.130)</td>
<td>7.101 (0.58)</td>
</tr>
<tr>
<td>$PCO_2$ (kPa)</td>
<td>4.71 (0.52)</td>
<td>7.20 (1.65)</td>
<td>8.10 (2.55)</td>
</tr>
<tr>
<td>$PO_2$ (kPa)</td>
<td>21.79 (6.83)*</td>
<td>3.74 (1.49)</td>
<td>1.91 (1.06)</td>
</tr>
<tr>
<td>Base deficit (mmol litre$^{-1}$)</td>
<td>6.9 (2.7)</td>
<td>8.4 (5.2)</td>
<td>10.5 (4.1)</td>
</tr>
</tbody>
</table>

include the results obtained from the four neonates who died postnatally.

**DISCUSSION**

In the King Edward VIII hospital obstetric service, hypertension constitutes the most common cause of maternal mortality, ahead of septic abortion, sepsis and haemorrhage. Of the 24403 deliveries in 1983, 17% of the mothers suffered from hypertension ($n = 4148$ patients). Amongst these, 151 cases of eclampsia were recorded. Our own experience is similar to that of Crowhurst and Rosen (1984), in that at least 50% of the patients presenting with pre-eclamptic toxemia require delivery by Caesarean section. The management of general anaesthesia for patients with hypertension is, therefore, a considerable clinical challenge in this hospital.

The accelerated induction of anaesthesia in all patients is almost invariably associated with a more marked reflex hypertensive response to laryngoscopy and intubation than is induction for routine anaesthesia. Furthermore, laryngoscopy and intubation in any patient with sustained diastolic arterial pressures of >120 mmHg results in an exaggerated reflex hypertensive response (Prys-Roberts, 1984). Hypertension in response to the accelerated induction is also exaggerated in pre-eclamptic/eclamptic patients, and represents the period of greatest potential risk to mother and fetus. Sudden increases in systolic arterial pressure in pre-eclamptic parturients is associated with a significantly increased incidence of cerebral haemorrhage and pulmonary oedema (Fox et al., 1977; Hodgkinson, Hinsain and Hayashi, 1980; Wright, 1983). Furthermore, the potentially lethal rupture of an intracranial aneurysm—should one be present, as is always a possibility in any pregnancy—is more likely to occur during the induction phase than at other times (Gianotta et al., 1986). If the severely hypertensive mother is to survive induction of anaesthesia, every effort has to be made not only to control hypertension, but also to prevent sudden increases in systemic and pulmonary arterial pressures consequent on the accelerated induction.

Wright (1983), in a detailed review of the anaesthetic management of pre-eclampsia/eclampsia, emphasized that the upper limit of cerebral autoregulation of blood flow in normotensive patients is an MAP of about 130 mm Hg. Above these pressures protective cerebral vasomotor reflexes are overwhelmed and the blood–brain barrier may be breached. In pre-eclampsia this may give rise to cerebral oedema, manifest clinically in the form of impaired consciousness in the absence of excessive sedation or recent convulsion (A. M. Richards, personal communication). Generalized cerebral oedema and discrete multifocal haemorrhagic lesions so generated can be visualized with computerized axial tomography and in postmortem specimens from patients who die of eclampsia (Richards et al., 1986). Laryngoscopy and intubation in severely hypertensive mothers are frequently accompanied by pressure peaks in excess of these values (Hodgkinson, Hinsain and Hayashi, 1980; Connell, Dalgleish and Downing, 1987).

Despite the known consequences of these pathophysiological sequelae to laryngoscopy and intubation, there is no clearly superior method of general anaesthetic induction for these hypertensive obstetric patients (Hodgkinson, Hinsain and Hyashi, 1980; James, 1982; Wheeler and Harris, 1982; Wright 1983; Marx and Bassell, 1984). At best, the management of hypertensive parturients at induction has been described as empirical (Crowhurst and Rosen, 1984).

Fentanyl demonstrably attenuates sudden increases in arterial pressure during intubation of patients undergoing neurosurgical procedures (Dahlgren and Messeter, 1981). The use of low dose fentanyl ameliorates the pressor response to
laryngoscopy in non-pregnant patients (Black, Kay and Healy, 1984) and, even in small doses, fentanyl significantly obounds the pressor response to tracheal intubation during accelerated induction (Cork et al., 1984). These authors demonstrated a significant inhibition of the increase in plasma noradrenaline concentration in those patients who received fentanyl. A close correlation exists between changes in mean arterial pressure occurring at laryngoscopy and circulating noradrenaline concentration (Derbyshire and Smith, 1984), particularly in hypertensive patients (Low et al., 1986).

In pre-eclampsia, patients exhibit a generalized vasoconstriction with an exaggerated response to vasopressors (Gutsche, 1979). Sustained release of catecholamines reduces uterine blood flow and may further compromise a fetus that is already at risk. Any anaesthetic technique that results in a reduction in circulating noradrenaline concentration would seem preferable for this reason alone.

The dose of fentanyl used by Cork and his colleagues (1984) in non-pregnant patients was approximately twice the mean dose used in our study (2.5—3.0 μg kg⁻¹). However, anaesthetic requirements in pregnancy have been shown to be reduced compared with those of non-pregnant patients (Palahnuik, Schneider and Eger, 1974).

The administration of an opioid given i.v. immediately before delivery of the neonate during Caesarean section is traditionally anathema to both obstetrician and anaesthetist. Fentanyl, however, when administered in low doses is free from significant consequences to the neonate when given to mothers within 10 min of delivery (Eisele, Wright and Rogge, 1982). Although the condition of the neonate at birth is generally an important consideration in the choice of anaesthetic agents, in pre-eclampsia and eclampsia the condition of the mother is always the anaesthetist's primary concern (Hibbard and Rosen, 1977). Furthermore, under the circumstances described, the use of pre-delivery opioids can be justified on the grounds of deliberately attempting “intrauterine resuscitation” (Myers and Myers, 1979; Myers and Williams, 1982). The advantages of blunting the pressor reflexes in the mother and thus averting hemiplegia, cardiac failure or death, far outweigh the disadvantages of managing a sedated neonate when an experienced neonatal resuscitation team is immediately available. With this point in mind, we suggest that the technique described is limited to those units with neonatal intensive care facilities and resident neonatologists experienced in the management of sedated neonates.

Pre-eclampsia and eclampsia are known to be associated with materno-fetal mismatching of placental perfusion secondary to variable pathological changes in placental basement membrane and vasculature (Wright, 1983). Without the specific pharmacological data available from maternal and fetal fentanyl concentration in humans, all predictions as to fetal blood and brain concentrations in the circumstances of this study are speculative, although one might anticipate materno-fetal transfer. In the ewe (Craft et al., 1983), the maternal concentrations of fentanyl remained 2.5 times greater than those found in the fetus from 5 to 60 min after injection. Cumulation was avoided in sheep by limiting the number of injections of fentanyl to a maximum of two. Further studies to elicit the transplacental pharmacokinetics of fentanyl and alfentanil in pre-eclampsia and eclampsia are currently in progress.

The pre-induction use of droperidol has been associated with the attenuation of the pressor response to intubation (Curran, Crowley and O’ Sullivan, 1980). Denlinger and colleagues (1976), Stoelting (1977, 1978) and Donegan and Bedford (1980) have demonstrated advantages in pre-treating patients with i.v. lignocaine in order to obtund the hypertensive response to intubation.

The assessment of neonates consisted of recording the time to sustained respiration and Apgar (minus colour) scores. These techniques, although crude, do differentiate clearly between those neonates who are in need of immediate resuscitation and those who are not—the specific reason for the introduction of these neonatal assessment methods to clinical practice. These tests do not, however, differentiate between asphyxiated and sedated infants, a purpose for which they were not designed. In order to make this distinction, more sensitive tests are required.

The data obtained from maternal and umbilical cord blood samples indicate that a good neonatal outcome based on the Apgar scores could be obtained, provided intrauterine asphyxia had not occurred. Severe disturbances of fetal acid-base (pH < 7.2) and blood-gas values were considered to be evidence of intrauterine asphyxia. We found that the use of fentanyl 200 μg i.v. before delivery was not associated with undue neonatal depression in the immediate postoperative period.
The patients in this study were drawn from the hypertensive group thought, from our previous experience (Connell, Dalgleish and Downing, 1987) and from information gleaned from the literature, to be in greatest danger (Lopez-Llera, Linares and Horta, 1976; Moodley, Naicker and Mankowitz, 1983). Connell and his colleagues (1987) reaffirmed the identity of a subgroup of pre-eclamptic patients who represent a considerably greater risk category amongst all pre-eclamptic and eclamptic patients. This group is characterized by being multiparous and 25 years of age or more. All the deaths in their study occurred in this older multiparous group, who also demonstrated more extreme hypertensive responses to the induction of anaesthesia (including laryngoscopy and intubation) (mean increase in SAP 90 mm Hg). The results of that study were of significance to this investigation. Indeed, the unmodified pressor response to laryngoscopy and intubation demonstrated by all the patients in the study by Connell and colleagues (1987), which was undertaken in this unit, had profound implications on the design of the present investigation. All patients in this present study were in this high risk category. In the light of the results consequent to the introduction of fentanyl to the induction sequence of severely hypertensive patients, we felt that the inclusion of a control group who would receive an otherwise similar anaesthetic, but without fentanyl and droperidol, was not ethically justified. Furthermore, because of the variable manifestation of individual organ involvement in severe pre-eclampsia and eclampsia, matching of patients for degrees of renal, cardiopulmonary, hepatic, haematological and cerebral involvement is extremely difficult. Although five of our patients did demonstrate severe pressure peaks during induction, 19 did not. We felt that this was a considerable improvement on the results reported by Connell, Dalgleish and Downing (1987) from this unit where, following a similar anaesthetic technique, but without fentanyl and droperidol, there were marked increases in arterial pressure in response to laryngoscopy and intubation. There were no deaths (in the present study) in this high-risk group who received the fentanyl-droperidol anaesthetic sequence.

The uncontrolled hypertension generated by the induction of anaesthesia in patients 5, 10, 13, 14 and 18 re-emphasizes the need for close cooperation between the obstetric and anaesthetic staff (Craig, 1972). Patient No. 5 had received no anti-hypertension therapy, but had been given magnesium sulphate. The specific drug or drugs used to control hypertension before anaesthesia would not appear to be critical. Provided an effective form of therapy has been initiated, the anaesthetic technique described appears to obtund the hypertensive response to laryngoscopy and intubation in the majority of patients. The experience of this unit is that i.v. bolus doses of 6.25–12.5 g hydralazine effectively control arterial pressure before transfer to theatre. In addition, magnesium sulphate given i.v. first as a bolus of 4 g, followed by an i.v. infusion of 2 g h⁻¹ is used. Fine control of arterial pressure just before anaesthesia may be achieved by the use of an infusion of 0.1% trimetaphan given as incremental bolus doses of 2.5 mg, although other agents have been used (Wright, 1983; Hood et al., 1985).

Twelve of our patients required supplements of trimetaphan over and above existing therapy to control arterial pressure before induction. The amelioration in pressor responses might, on first inspection, appear to be attributable to the use of trimetaphan rather than fentanyl. However, we have previously consistently used trimetaphan in cases of severe hypertension, in a routine attempt to control hypertensive responses following intubation, with poor results (Connell, Dalgleish and Downing, 1987). These, and the similar disappointing observations made by Hodgkinson and co-workers (1980), do not support the concept that control of hypertensive peaks following intubation can be achieved with trimetaphan alone in cases of severe hypertension. Mean arterial pressure is reduced by the use of this agent, but it would not appear to prevent pressure peaks consequent to catecholamine secretion. In effect, trimetaphan reduces the baseline pressure from which peak increases must start. Fentanyl, by inhibiting catecholamine secretion, probably prevents the generation of pressure peaks.

The postoperative management of these patients depended on their preoperative status. Patients who were conscious and alert before operation were allowed to awaken, neuromuscular blockade was antagonized and the trachea was extubated following bolus doses of trimetaphan. Our results, however, indicate that control of arterial pressure at the end of anaesthesia during laryngoscopy, pharyngeal suction and extubation was unsatisfactory. We are, therefore, currently
investigating the value of giving a further dose of synthetic opioid just before anaesthesia is discontinued.

In patients who were comatose before induction, the tracheal tube was left in situ and artificial ventilation continued for transfer to the neurosurgical unit. Evidence of gross cerebral oedema on CAT scan necessitated admission to the neurosurgical intensive care ward for the appropriate management (Richards et al., 1986).

In conclusion, the results of our preliminary studies presented here, suggest that administration of droperidol 5 mg and fentanyl 200 μg before induction effectively obtrunds the usual sympathetic hypertensive response to laryngoscopy and intubation in a significant majority of older, multiparous patients suffering from severe hypertension, who have received antihypertensive therapy before anaesthesia. The use of these agents immediately before delivery would not appear to cause significant neonatal depression in the immediate postoperative period in unanphyxiated (metabolically uncompromised) neonates. We believe that the anaesthetic technique described for the anaesthetic management of this subgroup of high risk hypertensive mothers, bears further consideration, especially in the light of our, present clinical experience of more than 200 patients treated in this manner since these data were collected. It must be emphasized that the subgroup of patients studied, namely older multipaerae, may represent a patient population that is infrequently observed where antenatal screening facilities are well developed. We wish to emphasize, therefore, that the management of these patients is a major undertaking that requires a wide range of invasive monitoring techniques and skills as well as both adult and neonatal intensive care facilities that are best provided in larger obstetric centres.

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FENTANYL-DROPERIDOL IN PRE-ECLAMPSIA/ECLAMPSIA


