Efficacy of augmentation of epidural analgesia for Caesarean section

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Background. Extension of a labour epidural for Caesarean delivery is thought to be successful in most cases and avoids the use of general anaesthesia. However, most previous studies that have estimated the failure rate of pre-existing epidural catheters were performed in small numbers of patients.

Methods. Therefore, we undertook to retrospectively measure the failure rate of indwelling epidural catheters in a large number of patients.

Results. The anaesthetic team was available at all times and was permanently led by a senior anaesthetist specialized in obstetrics. Extension was performed using lidocaine 2% with epinephrine (mean 18 (sd 6) ml), combined in most patients with sufentanil (9 (2.2) µg) and/or clonidine (75 µg). Among 194 consecutive extensions performed in a 1-yr period, general anaesthesia was required in five patients (2.6%) while sedation and/or i.v. analgesia were used in 27 patients (13.9%). In three cases where general anaesthesia was required, the interval between decision to incision was <10 min. No factor associated with failure could be identified. Addition of a lipophilic opioid or of clonidine did not modify the efficacy of the block (i.e. general anaesthesia or supplementation were required in a similar proportion).

Conclusions. The augmentation of labour epidurals for Caesarean section using lidocaine 2% plus epinephrine is a reliable and effective technique. No factor associated with failure could be identified.

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General anaesthesia for Caesarean section is associated with an increased risk of maternal mortality,¹² especially as it is often carried out in an emergency situation. It is therefore standard practice to use regional anaesthesia wherever possible. However, attaining high rates of regional anaesthesia in this context depends on both organizational and technical factors.³ The use of epidurals during labour affords the possibility of rapid augmentation (i.e. injection through the catheter of a dose of a local anaesthetic of a suitable concentration for surgery) to provide anaesthesia in the case of emergency Caesarean section.

Several studies have sought to determine which local anaesthetic, at what dose, and in combination with which other agents (epinephrine, clonidine, opioids, bicarbonate) is most effective.³⁶ Although chloropracaine 3% may have the fastest onset, this agent is not available in most European countries.⁷ A study by Price and colleagues⁸ in 1991 showed that the epidural injection of lidocaine 2%, 20 ml with epinephrine 1:200 000 reliably augmented a labour epidural within the time frame necessary for urgent Caesarean section. Indeed, they reported a 100% success rate using this method. However, because of the small number of patients (n=36) in that study, the true efficacy of this technique remains questionable.

We adopted the practice of extending labour epidurals for Caesarean section with a large dose of lidocaine in 1991.
Our primary hypothesis was to verify that ‘extension’ of an epidural analgesia previously used during labour is successful in most cases and avoids the use of general anaesthesia. This retrospective study evaluates the technique by analysing the anaesthetic records of a large number of women undergoing emergency Caesarean section during labour. We have also sought to identify factors that are associated with failure of the technique in these cases.

Methods

The obstetric unit at our hospital manages approximately 2500 deliveries per year and has a 20% Caesarean section rate. The institution procedure of epidural labour analgesia is based on a combination of bupivacaine 0.08% and sufentanil 0.5 μg ml⁻¹ used as an epidural infusion after an initial bolus of 15 ml of the same solution. More than 90% of women in labour receive an epidural during labour. Top-ups during labour are also made with the same solution. All parturients receive this mixture. The anaesthetic team is available at all times and is permanently led by a senior anaesthetist specialized in obstetrics. The case notes of all available at all times and is permanently led by a senior anaesthetist specialized in obstetrics. The case notes of all parturients receive this mixture. The anaesthetic team is available at all times and is permanently led by a senior anaesthetist specialized in obstetrics. The case notes of all

Results

In total, 315 non-elective Caesarean sections were carried out in this 1-yr period. Of these, 35 had missing or incomplete case notes. Of the remaining 280, 194 were cases in which the anaesthetic technique initially chosen was augmentation of a pre-existing labour epidural. Within this group, general anaesthesia was used 5 times (2.6% (95% CI 0.8–5.8)). One case was attributable to ‘maternal distress caused by anxiety’, despite an adequate sensory block having been demonstrated. Four patients required general anaesthesia because of inadequate cephalic extension of the epidural block. In one patient, spread remained limited although sufficient time had elapsed after topping up. In the three other patients, the time interval available between the decision to perform a Caesarean section and incision was <10 min. When the time available between decision to perform a Caesarean section and incision was <10 min, 25% of patients required supplementation (13% ± 13.6% when the time available was >10 min; P=0.078).

I.V. or inhaled supplementation was necessary in 27 patients (13.9%). There was no significant difference in patient characteristics, anaesthetic data, or data pertaining to the sitting and analgesic adequacy of the labour epidural and colleagues (i.e. three or more interventions aimed at improving the quality of the analgesia, e.g. epidural bolus, increase of the epidural infusion flow rate).

(v) Data pertaining to the augmentation of the epidural for Caesarean section: grade of anaesthetist present (senior or trainee); sensory level (to temperature) before augmentation; volume of lidocaine 2% with epinephrine 1:200 000 used; dose of epidural sufentanil used; dose of epidural clonidine used; sensory level after augmentation; inadequate augmentation defined as when i.v. or inhaled supplementation (midazolam, opioids, volatile anaesthetics, nitrous oxide) was used, but without recourse to general anaesthesia; augmentation-incision time interval.

(vi) Obstetric data: gravidity; parity; term; fetal presentation; presence of multiple pregnancy; duration of labour; time interval between decision to perform Caesarean and incision (greater or less than 10 min).

(vii) Neonatal data: Apgar scores at 1 and 5 min; umbilical artery pH.

(viii) Failure of extension. Epidural anaesthesia was deemed to have failed if general anaesthesia became necessary. Results are given as a mean (SD) for continuous variables and median (range) for discontinuous variables. Qualitative variables are expressed as a percentage. Statistical analysis was performed using Student’s t-test for unpaired and normally distributed variables and the χ²-test to compare percentages (Statview® 5.0 for Macintosh, SAS Institute Inc., NC, USA). The Mann–Whitney U-test was used to compare discontinuous data. A P-value of <0.05 was considered significant.
between those who had (had not) adequate extension (Tables 1–3). There was no relationship between the use of epidural clonidine and/or sufentanil and the need for supplementation (Table 2). Trainee and senior anaesthetists provided adequate anaesthesia without supplementation in 83% and 84% of the cases respectively.

**Discussion**

In this study, augmentation of a labour epidural for Caesarean section failed to the point of recourse to general anaesthesia in 2.6% of patients. This confirms the efficacy of the technique. None of the factors pertaining to the experience of the anaesthetist, location of the epidural, or its analgesic efficacy during labour were found to be associated with an increased risk of failure. In three of the five failures, the time before efficient block was too long, indicating that the failure rate could have been larger had we studied only emergency situations where there is immediate threat to life of the mother or fetus. In the other cases, the duration was 14 (7) min, which is similar to previous reports.

This failure rate is towards the lower end of the range of failure rates reported elsewhere. Price and colleagues and Gaiser and colleagues reported failure rates of zero. Others have reported rates of 5.7%, 10 7%, 3 8%, 11 or up to 38%. In the largest study to date (n=827), the incidence of conversion to general anaesthesia with an epidural catheter in situ was 10.5%. Although almost all epidural Caesarean sections were non-elective, the exact proportion is not stated. In that study, however, excluding patients in whom top-up was not attempted, left a failure rate of 2.2%, a result very close to ours. Our results are also close to those of Tsen and colleagues, despite their study including elective Caesarean sections as well as emergencies. These differences in failure rates might be explained by variable (and sometimes unspecified) definitions of failure. In our study, if we had included cases in which i.v. or inhaled supplementation was necessary, the ‘failure’ rate would have risen to 16.5%.

We found no factors associated with failure (technical conditions, height, weight, depth of the epidural space, length of catheter in space, duration of labour, use of combined spinal epidural anaesthesia). Because this might have been related to the very small number of failures (n=5), analysis was performed again to search for risk factors for supplementation, but no single factor could be found (Tables 1–3). In contrast, Riley and colleagues found that the need for supplementary epidural boluses during labour and management by a non-obstetric anaesthetist were risk factors for the failure of augmentation. A major difference might be that our patients are cared for night and day by an anaesthetist specialized in obstetrics.

At our institution, we only use lidocaine to augment labour epidurals for emergency Caesarean section. Our practice is therefore similar to that of Riley and colleagues. The choice of agent is an important one. Establishment of a sensory block is more rapid with chloroprocaine, but the difference is clinically small and this agent is not available in France. Lucas and colleagues observed a higher success rate for augmentation of the epidural block using bupivacaine rather than lidocaine. However, the volume of bupivacaine necessary was large (20 ml). Indeed, Dickson and colleagues, using bupivacaine 0.5%, 10 ml observed that ~30 min were necessary to extend the block height to T4. This delay is incompatible with emergency Caesarean section. Moreover, rapid injection of high doses of bupivacaine exposes the patient to the risks of cardiotoxicity. For these reasons, we use lidocaine.

We found that the addition of opioids and/or clonidine did not decrease the need for supplementation. This is surprising given the analgesic efficacy of these substances in other clinical situations. A possible explanation is that pre-existing partial conduction block, caused by the local anaesthetic agents used during labour, allows a subsequent dose to increase the density of the block very rapidly. Another possible explanation is the insufficient power of our study. Power calculations indicate that two groups of 293 patients each would be necessary to demonstrate any
difference attributable to sufentanil. However, large numbers needed to demonstrate a difference suggest that the effect, if any, is small and possibly not relevant to clinical practice.

The augmentation of labour epidurals for Caesarean section is a reliable and effective technique. The addition of opioids and/or clonidine to the local anaesthetic does not appear to decrease failure rate or the need for supplementation.

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