

## Review Article

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## Analgesia and the Outcome of Labor

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### ABSTRACT

Epidural block is the only available effective method of labor analgesia. Many investigators have asked the question: Does epidural analgesia prolong labor? This thought that epidural analgesia prolongs labor arose in the 1950's. Women receiving epidural analgesia often have longer labors than those who do not. It is attributed to the effects of epidural analgesia. While the use of epidural labor analgesia may correlate with abnormal labor and cesarean delivery, this association is not caused by epidural analgesia itself. This review discusses the evidence published in literature and the impact of obstetric management on the risk of cesarean delivery associated with epidural analgesia (*Rev Mex Anest* 1999;22:254-260).

**Key Words:** Epidural analgesia, complications, labor, cesarean delivery

### RESUMEN

**Analgesia y trabajo de parto.** El bloqueo epidural es actualmente el único medio efectivo y más seguro disponible para analgesia en el trabajo de parto. Muchos investigadores se han preguntado: la analgesia epidural, ¿prolonga el trabajo de parto? Esta suposición data desde los años 50s. El trabajo de parto prolongado se asocia con mujeres que han recibido analgesia epidural cuando se comparan con aquellas que no recibieron analgesia epidural, sin embargo, aunque la analgesia epidural puede correlacionarse con trabajo de parto anormal y cesárea, esta asociación no es causada por la analgesia epidural propiamente dicha. La presente revisión discute la evidencia publicada en la literatura y el impacto del manejo obstétrico sobre el riesgo de operación cesárea asociada con analgesia epidural (*Rev Mex Anest* 1999;22:254-260).

**Palabras Clave:** Analgesia epidural, complicaciones, trabajo de parto prolongado, cesárea

EPIDURAL BLOCK is the only available effective method of labor analgesia. Some obstetricians and parts of the lay public have long claimed that labor epidural analgesia has a harmful effect on the progress and outcome of labor. Epidural analgesia has been accused of stopping contractions, slowing labor and increasing the incidence of malpresentation and the need for cesarean delivery.

The thought that epidural analgesia prolongs labor arose in the 1950's. This accusation is based on a few retrospective, biased, uncontrolled studies of outmoded anesthetic techniques. The studies most often quoted examine the effect of caudal, not lum-

bar, epidural block on labor.<sup>1,2</sup> The results these authors reported actually show little or no effect of regional anesthesia on the progress of labor. In one study, Friedman and Sachtleben found it "rather odd" that their data did not reflect any slowing of cervical dilation with "premature" (< 7 cm) caudal anesthesia.<sup>1</sup> In a follow-up study, they could attribute only 5.9% of cases of prolonged latent labor to caudal anesthesia.<sup>2</sup> These conclusions have been exaggerated with time. In their follow-up study, Friedman and Sachtleben claimed that their initial study documented "the sensitivity of early labor to major regional-conduction anesthesia".<sup>2</sup>

Study design, investigator bias and anesthetic technique contribute to the "harmful" effects of epidural analgesia on the progress and outcome of labor. However, most of the purported harmful effects

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of labor epidural analgesia result from patient factors (women having abnormal labors are more likely to request epidural block) and obstetrical decisions, not from the analgesic technique itself.

### Epidural Analgesia and Uterine Activity

One means by which epidural analgesia may slow labor is by decreasing uterine activity. Several investigators reported a transient decrease in the frequency and intensity of contractions after induction of labor epidural analgesia.<sup>3-5</sup> This effect was greater when epinephrine, 1:200,000 was included in the injectate.<sup>4,5</sup> However, these authors positioned their patients supine, without left uterine displacement and did not control fluid management. Merely placing a parturient in the supine position decreases uterine activity.<sup>6</sup> When patients are nursed in the lateral position, labor epidural analgesia has no effect on the frequency or intensity of uterine contractions.<sup>7,8</sup> Rapid fluid administration before epidural blockade also can transiently decrease uterine activity.<sup>9,10</sup> Epidural block without fluid loading is associated with increased uterine activity, but no increased risk of hypotension (table 1).<sup>9</sup>

### Epidural Analgesia and Prolonged Labor

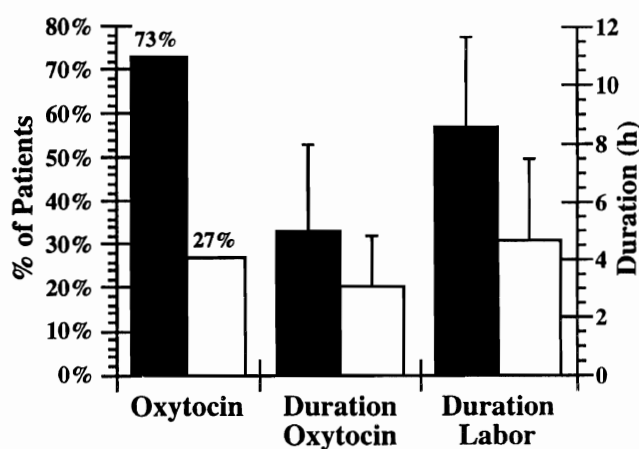
Many investigators have asked the question: Does epidural analgesia prolong labor? Although studies often find a correlation between epidural analgesia and long labor, because of their design, they cannot separate cause and effect. Retrospective and nonrandomized designs suffer from a serious flaw: women do not choose epidural analgesia randomly. Most clinical reports blame the correlation between epidural block and various adverse outcomes directly on the anesthetic. What investigators often fail to consider is that the condition prompting the woman to request analgesia (painful labor), not the epidural technique itself, may cause the adverse outcome.

Women receiving epidural analgesia often have longer labors than those who do not. So, some investigators claim that epidural block hinders uterine contractility and slows labor.<sup>8</sup> This effect is supposedly most significant if epidural analgesia is induced early in the course of labor.<sup>11</sup> Thorp and colleagues published a typical study examining the "effect" of epidural analgesia on the progress of labor.<sup>12</sup> They reviewed the records of 711 term, nulliparae with spontaneous labors. They divided these

**Table 1.** Intravenous fluids and induction of epidural analgesia and uterine activity in laboring women.

Group	After Fluids	After Epidural
125 mL / h	No Change	↑
500 mL / Bolus	No Change	No Change
1000 mL / Bolus	↓	No Change

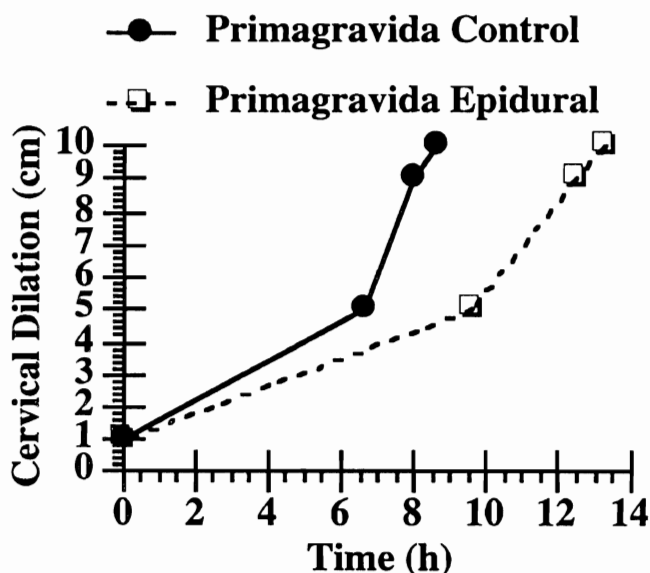
Data from: Cheek TG, et al. *Anaesthesia* 1996;77:632<sup>9</sup>



**Figure 1.** "Effect" of epidural analgesia on the progress of labor. Women who received labor epidural analgesia were more likely to receive oxytocin augmentation. They also had longer labors than women receiving either no analgesia or meperidine. Data from Thorp JA, et al. *Am J Obstet Gynecol* 1989;161:670<sup>12</sup>

women into two groups according to their need for analgesia (epidural,  $n = 447$ , nothing/i.v. narcotics,  $n = 264$ ). Women in the epidural group were more likely to receive oxytocin augmentation and had longer labors than those in the no epidural group. Thorp et al. attributed these effects to epidural analgesia<sup>12</sup> (figure 1).

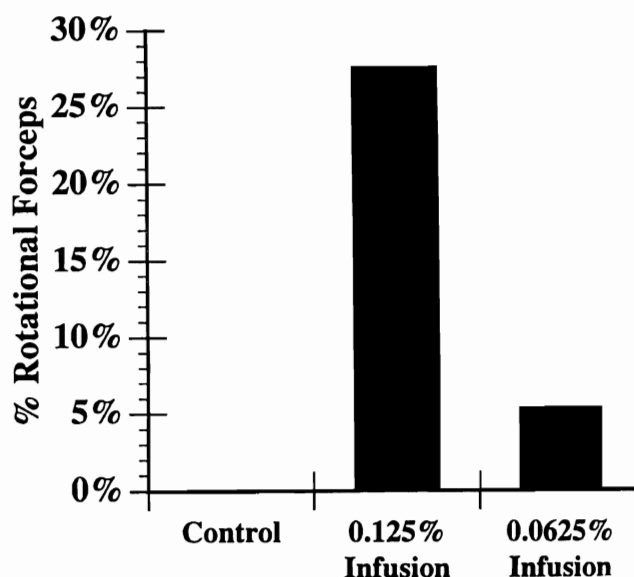
However, women do not choose epidural analgesia randomly. Parturients with severe pain are more likely to request epidural analgesia. Painful labor is more likely to be abnormally prolonged and complicated. Wuitchik et al. recorded subjective pain evaluations during latent labor. Women who suffered "horrible" or "excruciating" pain during latent labor had significantly longer active labors than did women who had only "discomforting" pain (9.6 h vs. 3.8 h).<sup>13</sup> Other studies also show that women who eventually request epidural analgesia have pro-



**Figure 2.** Average labor curves of nulliparae in spontaneous labor who requested epidural analgesia and a similar group who did not (controls). Epidural analgesia was induced at 4 cm cervical dilation. The women requesting epidural block had slower rates of cervical dilatation before the induction of analgesia. Data from: Willdeck-Lund G, et al. *Acta Anesth Scand* 1979;23:301<sup>14</sup>

longed, painful labor even before they receive pain relief. These women arrive at the hospital with less cervical change (3.0 vs 4.8 cm) and with fetuses higher in the pelvis than women who request no analgesia (figure 2).<sup>12,14,15</sup> They have slower rates of cervical dilatation before induction of epidural block.<sup>14,15</sup> They have bigger babies.<sup>12,14,15</sup> These babies are more likely to present in the occiput transverse or posterior position.<sup>2</sup> These factors, which cause, or result from, slow, painful, labor occur before the induction of epidural block. Thus, women with abnormal labors are more likely to request epidural analgesia.<sup>16</sup> It should come as no surprise that these labors remain abnormal after the induction of epidural block.

Recently, several groups have reported randomized prospective trials examining the impact of epidural analgesia on the progress of labor.<sup>16-21</sup> Unfortunately, interpretation of each of these studies is complicated by the frequent occurrence of protocol violations. When data analysis includes all patients assigned to each group (intent-to-treat analysis), there is usually no difference in the duration of labor between the two groups.<sup>16,20</sup> However, when data analysis includes only patients who re-



**Figure 3.** Concentration of epidural local anesthetic vs. use of rotational forceps. Dilute local opioid mixtures are associated with a decreased need for rotational forceps. Data from: Hoult IJ, et al. *Br Med J* 1977;1:14<sup>25</sup>

ceive only their assigned treatment (protocol compliant patients), women receiving epidural analgesia have longer labors and receive more oxytocin.<sup>16-19</sup> This effect is not surprising given the opposing reasons that women do not receive their allocated treatments. Protocol non-compliant women assigned to the epidural group either refused analgesia or progressed too rapidly to receive their allocated technique. Non-compliant women in the meperidine group often demanded epidural analgesia because they failed to obtain adequate relief from their allocated analgesic. Thus, women with shorter, less painful labors were preferentially excluded from the epidural groups, while those with longer, more painful labors removed themselves from the meperidine groups.<sup>16</sup>

The timing of epidural analgesia has no impact on the duration of labor. Two prospective, randomized studies found differences in the duration of labor with induction of epidural block in early (< 5 cm cervical dilation) versus more advanced labor.<sup>22,23</sup>

Thus, the impact of epidural analgesia on the duration of labor remains controversial. While some studies suggest that epidural block prolongs labor, others find no effect. The timing of epidural analgesia lacks effect on labor progress.

## Epidural Analgesia and Malpresentation

Another purported risk of epidural analgesia is an increased incidence of malpresentation. Studies have reported a 20 – 26% incidence of malpresentation associated with the use of epidural analgesia (figure 3).<sup>17,24,25</sup> This risk may be more related to maternal factors and technical issues than to epidural block per se.

Smaller maternal pelvic outlet capacity predicts fetal malpresentation (and the need for epidural analgesia).<sup>1,26</sup> Thus women at increased risk of malpresentation are more likely to request epidural analgesia.

Changes in epidural technique also affect the incidence of malpresentation. One practice changed from intermittent injections of 0.375% bupivacaine with 1:200,000 epinephrine to bolus doses of 0.125% bupivacaine with 2 – 5 µg/mL fentanyl. The incidence of fetal head malposition decreased from 26% to 5%. Four percent of women who did not need labor analgesia had malpositioned fetal heads.<sup>21</sup> In another practice, the need for midforceps rotations fell from 16% to 10% to 5% as anesthetic technique changed from intermittent injections of 1.5% lidocaine with 1:200,000 epinephrine to continuous infusion of 0.125% bupivacaine with 2 µg/mL fentanyl to 0.0625% bupivacaine with 0.3 µg/mL sufentanil.<sup>27</sup> In a prospective, randomized study, decreasing the concentration of infused bupivacaine (from 0.125% with 1 µg/mL fentanyl to 0.0625% with 1 µg/mL fentanyl) decreased the use of rotational forceps from 28% to 7%.<sup>28</sup>

## Epidural Analgesia and Instrumental Delivery

Both fetal head malposition and motor blockade can increase the need for forceps or vacuum delivery. Many studies report a correlation between labor epidural analgesia and instrumental delivery.<sup>8,25,29</sup> Most of these studies are retrospective, nonrandomized and do not control the indications for forceps delivery. Women with well functioning labor epidural catheters will tolerate instrumental delivery better than those with no analgesia. Thus, they may be more likely candidates for intervention.

Randomized comparisons of epidural and systemic labor analgesia often show no increased use of forceps or vacuum at delivery<sup>30</sup>, especially when their elective use is not allowed.<sup>19,21</sup>

Changes in anesthetic and obstetrical man-

agement can eliminate any effect that epidural analgesia may have on the need for forceps delivery. Epidural opioids can decrease the amount of local anesthetic needed to provide maternal analgesia. These more dilute local anesthetic-opioid solutions produce less maternal motor block and have less effect on the mode of vaginal delivery. Providing second stage analgesia with a continuous infusion of 0.0625% bupivacaine with 0.0002% fentanyl results in the same need for forceps as infusing normal saline.<sup>31</sup> Adding 10 µg of sufentanil to a 10 mL bolus of 0.125% bupivacaine with 1:800,000 epinephrine significantly decreases both the amount of bupivacaine needed to provide labor analgesia and the frequency of instrumental delivery.<sup>32</sup>

As with prolonged labor, the correlation between epidural analgesia and malposition reflects the impact of a painful condition (malpresentation) on the choice of pain relief as much as the effect of epidural analgesia on the incidence of an obstetric complication. What influence epidural analgesia may have on malposition and the second stage of labor can be minimized or eliminated by using the least amount of local anesthetic possible.

## Epidural Analgesia and Cesarean Delivery

Multiple studies have shown examined the association between epidural analgesia and cesarean delivery.<sup>8,11,12,16-21</sup> Some of these studies are nonrandomized and cannot control for selection bias.<sup>8,11,33</sup> (Women do not request epidural analgesia randomly. As noted above, parturients experiencing a prolonged, abnormal, painful labor are more likely to request epidural analgesia than are those who have a rapid, uncomplicated labor).

Two prospective, randomized studies reported an increased risk of cesarean section associated with epidural analgesia.<sup>17,18</sup> Both of the studies suffer significant flaws. One compared outcomes in 48 women receiving epidural analgesia (0.25% bupivacaine bolus and 0.125% bupivacaine infusion) and 45 women receiving intravenous meperidine/promethazine for labor analgesia. The incidence of cesarean section for dystocia was 16.7% in the epidural group but only 2.2% in the meperidine group.<sup>17</sup> The authors had intended to study 200 women but stopped at 93 because they had attained a statistically significant difference. The perils of this choice should be obvious. A difference of one cesarean section in either group would have eliminated the statistical significance of their result.

**Table 2.** Impact of epidural analgesia on the method of delivery. Intent - to - treat analysis.

Method of delivery	Epidural Analgesia (N = 358)	Patient controlled Intravenous analgesia (N = 357)	p value
Spontaneous	319 (89)	326 (91)	NS
Instrumental vaginal	26 (7)	15 (4)	NS
Low Forceps	22 (6)	12 (3)	NS
Outlet Forceps	4 (1)	3 (1)	NS
Cesarean Delivery	13 (4)	16 (5)	NS
Dystocia	9 (3)	10 (3)	NS
Nonreassuring FHR tracing	4 (1)	6 (2)	NS
Total operative delivery	39 (11)	31 (9)	NS

Data are N (%). Data from: Sharma SK, et al. *Anesthesiology* 1997;87:487<sup>19</sup>

Similar small studies compared epidural analgesia (with 1.0 - 1.5 µg/mL fentanyl added to the above solutions) and intravenous butorphanol or meperidine in laboring women.<sup>16,20</sup> Here, the incidence of cesarean section for dystocia was similar in the two groups (8% vs. 6%<sup>20</sup> and 5.8% vs. 10.5%<sup>16</sup>). These studies suggest that there is no increase in dystocia-related cesarean section associated with the use of epidural labor analgesia.

Larger studies can provide more robust answers to this question, but suffer from limitations of their own. Ramin et al. enrolled 1330 women in a randomized comparison of epidural analgesia (0.25% bupivacaine bolus and 0.125% bupivacaine with 2 µg/mL fentanyl infusion) in intermittent intravenous meperidine/promethazine.<sup>18</sup> Among the women who received their allocated method of analgesia (protocol compliant patients), there was a 2-4 fold greater risk of dystocia-related cesarean section associated with

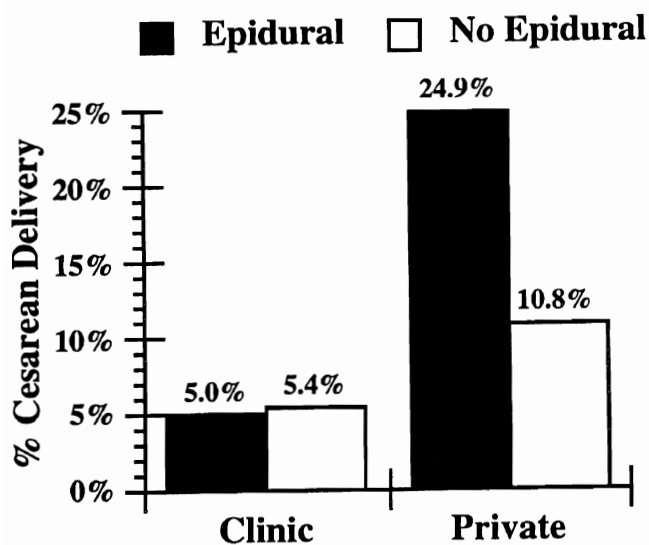
epidural analgesia. However, only 65% of patients in each group received their randomly chosen analgesic technique. Most notable, 103 women assigned to the meperidine group received epidural analgesia after meperidine proved inadequate. When all patients were included in the data analysis (intent-to-treat analysis), the difference in the risk of dystocia-related cesarean section associated with epidural analgesia disappeared. However, women in the epidural group were more likely to require "operative (forceps or surgical) delivery for dystocia" (9% vs. 5%).<sup>18</sup>

These authors enrolled 715 women in a follow-up study that compared epidural analgesia to patient controlled intravenous analgesia (PCIA). Now, only 5 women in the meperidine group received epidural analgesia. Analysis of both protocol compliant patients or all patients failed to find any increased risk of cesarean section associated with epidural analgesia (tables 2 & 3).<sup>19</sup>

**Table 3.** Impact of epidural analgesia on the method of delivery in protocol complaint patients

Method of delivery	Epidural Analgesia (N = 243)	Patient controlled Intravenous analgesia (N = 259)	p value
Spontaneous	209 (86)	236 (91)	NS
Instrumental vaginal	22 (9)	9 (3)	0.01
Low Forceps	18 (7)	8 (3)	< 0.05
Outlet Forceps	4 (2)	1	NS
Cesarean Delivery	12 (5)	14 (6)	NS
Dystocia	8 (3)	10 (4)	NS
Nonreassuring FHR tracing	4 (2)	4 (2)	NS
Total operative delivery	34 (14)	23 (9)	NS

Data from: Sharma SK, et al. *Anesthesiology* 1997;87:487<sup>19</sup>



**Figure 4.** The impact of obstetric management on the risk of cesarean delivery associated with epidural analgesia. Nulliparae with vertex fetuses were managed by either private and clinical physicians at a single metropolitan hospital. Forty two percent of women in each group received labor epidural analgesia. Obstetric outcomes were identical. Data from: Neuhoﬀ D, et al. *Obstet Gynecol* 1989;73:915<sup>34</sup>

A similar study, from the same institution compared the frequency of cesarean delivery in women receiving either combined spinal-epidural analgesia or intravenous meperidine.<sup>21</sup> Again, assignment to the regional analgesia group did not increase the risk of cesarean delivery for dystocia (3.5% vs 4.0%).

Obstetrical management may contribute to the "effect" of epidural analgesia on the frequency

of cesarean delivery. Neuhoﬀ et al<sup>34</sup>, examined the frequency of cesarean delivery in two groups of patients delivering in a single hospital (figure 4). The use of epidural labor analgesia was similar in both groups of women (42%). In private patients, the incidence of cesarean section for dystocia increased from 9.1% to 20.2% with the use of epidural labor analgesia. In clinic patients, however, the incidence of dystocia-related cesarean delivery remained unchanged by the use of epidural analgesia (0% vs. 1.2%).<sup>34</sup>

There are other ways to examine the effects of epidural analgesia on the risk of cesarean delivery. Several groups have examined the impact of a sudden change in the use of epidural labor analgesia on the frequency of cesarean delivery.<sup>35-38</sup> Changes in the availability of epidural labor analgesia did not affect the frequency of dystocia-related cesarean delivery. However, when epidural analgesia was readily available, women who received this intervention were 8 times more likely to have a cesarean delivery than women who did not (table 4).<sup>36</sup> These results suggest that epidural analgesia does not increase the risk of cesarean delivery, but women at high risk for cesarean delivery are likely to request effective pain relief when it is available.

In summary, while the use of epidural labor analgesia may correlate with abnormal labor and cesarean delivery, this association is not caused by epidural analgesia itself. Women request analgesia because they are having pain. Severe pain is a symptom of abnormal labor. This painful, abnormal labor causes both the request for epidural labor analgesia and the complications often attributed to epidural block.

**Table 4.** Epidural analgesia and cesarean delivery rates before and after sudden change in the use of epidural analgesia. Dystocia cesarean delivery rates in women who did and did not receive epidural analgesia

Source (ref)	N (Before vs After)	Parity	% Epidural (Before vs After)	Total C/S Before vs After	Dystocia C/S Before vs After	Dystocia C/S After - Epidural vs After - no Epidural
Johnson and Rosenfeld <sup>36</sup>	116 vs 103	Mixed	71 vs 21	17.2 vs 18.4	-----	-----
Lyon et al <sup>35</sup>	373 vs 421	Nulliparae	13 vs 59	11.8 vs 10.0	7.8 vs 5.2	8.1 vs 1.1
Gribble and Meier <sup>33</sup>	526 vs 425	Nulliparae	0 vs 61	16.7 vs 16.0	14.4 vs 14.4	18.8 vs 7.9
	772 vs 659	Multiparae	0 vs 38	3.8 vs 3.2	2.6 vs 1.5	2.8 vs 0.7
	1298 vs 1084	Mixed	0 vs 47	9.0 vs 8.2	7.4 vs 6.5	11.2 vs 2.8
Foger et al <sup>34</sup>	3195 vs 3733	Mixed	1 vs 29	9.1 vs 9.7	3.0 vs 3.1	8.0 vs 1.0

Data from: Fogel ST, et al. *Anesth Analg* 1998;87:119<sup>36</sup>

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