Effect of Osteopathic Obstetrical Management on the Duration of Labor in the Inpatient Setting: A Prospective Study and Literature Review

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Context: Several studies have investigated the effects of osteopathic manipulative treatment (OMT) on labor duration, but the outcomes remain ambiguous. Confounding the relationship between OMT and labor duration is the lack of standardization between treatment settings, gestational ages at the time of treatment, OMT techniques, and overall obstetrical management principles from foundational and modern osteopathic approaches.

Objective: To evaluate the effect of OMT on labor duration when applied in tandem with standard obstetrical management in the inpatient setting.

Methods: This pilot prospective observational study was conducted from June 2017 through September 2017. All patients who received OMT as part of their labor management were included. These patients were matched with controls who did not receive OMT. The OMT protocol involved once-daily administration of suboccipital decompression, thoracic inlet release, rib raising, paraspinal inhibition, and sacral inhibition. Obstetrical decisions regarding labor management were made by 1 senior attending osteopathic obstetrician. Labor management as well as OMT was carried out by osteopathic obstetricians in the OMT group, whereas allopathic obstetricians carried out labor management in the control group.

Results: A total of 100 patients were enrolled. Fifty patients who underwent adjunctive OMT in addition to standard labor management were matched to controls who received standard labor management only. Each group was represented by an ethnically diverse population. The mean (SD) labor duration for patients receiving OMT was significantly shorter than the labor duration for controls (11.34 [6.62] hours [range, 1.1-27.0 hours] vs 16.57 [4.39] [range, 1.0-58.8 hours], respectively; P=.03). All other measures studied did not achieve statistical significance.

Conclusion: Pregnancy and labor present many musculoskeletal and neurovisceral challenges to obstetrical patients and, to the authors’ knowledge, this is the first study to present an effective, efficient, and feasible approach to intrapartum osteopathic obstetrical management in the inpatient setting to reduce labor duration.


Keywords: labor duration, OMT, osteopathic medicine, pregnancy

The principles and practice of osteopathic medicine as they apply to the field of obstetrics has a long tradition, with a dedicated chapter starting from the first book by Andrew Taylor Still, MD, DO, titled The Philosophy and Mechanical
Principles of Osteopathy, to which the area of obstetrics has a dedicated chapter. According to Zink, “traditionally, osteopathic manipulative management of the obstetric patient has been limited to soft tissue relaxation especially to the lumbar region and, occasionally, to making corrections of the isolated somatic dysfunctions.” Despite research into the effects of osteopathic manipulative treatment (OMT) on labor duration, the outcomes remain ambiguous. Earlier studies by Hart and Whiting demonstrated a shortening of labor duration, whereas more recent studies by Hensel et al reported an increase in labor duration. Confounding the relationship between OMT and labor duration further is the lack of standardization between treatment settings (eg, outpatient, inpatient), gestational ages at time of treatment (term or before term), treatment techniques, and overall obstetrical management principles from foundational and modern osteopathic approaches.

Pregnancy in the third trimester and intrapartum labor course present many challenges to the musculoskeletal and neurovisceral framework of the obstetric patient. The sympathetic innervation to the female pelvic viscera is derived from nerves at the spinal levels of T10-12 and L1-2. Nociceptive fibers also follow these tracts and share interneurons with musculoskeletal nociceptive fibers at the same levels. Parasympathetic innervation arises from S2-4 through the pelvic splanchnic nerves. The vagus nerve (cranial nerve 10 [CN10]) also plays a role in the innervation of the uterus, as evidenced by studies demonstrating how pregnant women with transection of the spinal cord can still achieve parturition. Animal studies have also demonstrated the effect of CN10 on the vagina, uterus, and cervix though uterine innervation by CN10 is less well understood. Changes in anterior/posterior curves during pregnancy can facilitate segments and lower pain thresholds due to negative effects on the aforementioned autonomic framework.

Additionally, as the curves progress, an increase in the tortuosity of viscera is observed, leading to compression and venous congestion, especially in the vasculature encased in the broad ligament of the uterus. This congestion is further compounded due to the increased mass and size of the gravid uterus and the growing fetus therein exerting compression on the inferior vena cava among other smaller-caliber venous vasculature and attendant lymphatic vessels. Respiratory and circulatory functions are thus subsequently altered, leading to commonly found constipation, edema, poor circulation, and backache. In addition, nerve conduction and circulation to the uterus is impaired, affecting uterine contractility and labor progression.

Hence, the justification for OMT applied in the current study is the need to reduce venous congestion inherent in the physiologic problems in pregnancy, reduce labor time as much as possible to minimize complications that result from an increased labor time, and reduce the somatic pain and psychological stresses due to a prolonged pregnancy. All such components may be reduced with a shorter duration of labor. Thus, if OMT can reduce labor time in this setting, there is a well-justified use for generalized application of OMT in the intrapartum setting. While measuring these individual components (eg, pain scale) are important, the purpose of this study was to evaluate whether an OMT protocol designed to address inherent structural and neurovascular components in the inpatient setting using standard obstetric and osteopathic care could reduce overall labor duration in a feasible manner.

Methods
This pilot prospective observational study was conducted from June 2017 through September 2017 at New York Langone Hospital–Brooklyn. Informed consent was obtained from each patient, and approval was obtained from the institutional review boards at New York University Langone Hospital–Brooklyn and New York University School of Medicine.

Patients
Patients who were admitted to the labor and delivery department were included and grouped into an OMT
group (OMT protocol and standard labor management) and a control group (standard labor management alone).

Patients who consented to OMT as part of their labor management and were given a trial of labor management with the expectation of vaginal delivery were included. Patients were excluded if there were any absolute contraindications to OMT in the intrapartum setting, which included acute abdomen, blood pressure higher than 160/110 mm Hg, unexplained visual disturbances, heavy vaginal bleeding preceding delivery, less than 34 weeks' gestational age, treatment refusal, magnesium sulfate received for seizure prophylaxis in the setting of preeclampsia with severe features or severe gestational hypertension, or scheduled cesarean delivery owing to prior obstetrical conditions.

OMT Protocol

Each patient provided verbal consent for specific OMT techniques. The OMT protocol was provided by 3 osteopathic physicians (S.H., S.R., and G.C.) in tandem with obstetrical management by the same physicians, and the OMT protocol and obstetrical management was standardized among the 3 physicians.

Before administration of OMT, a focused osteopathic structural examination was performed focusing on T12-L2, the sacrum, lower extremities, and Chapman points for the uterus and broad ligaments; the examination was repeated on the morning of postpartum day 1. The OMT protocol itself was designed to address the sympathetic innervation of the uterus (T12-L2), the parasympathetic innervation of the uterus (CN10 and S2-4), and venous and lymphatic congestion of the abdomen and pelvis. The OMT protocol involved once daily administration of suboccipital decompression (CN10), thoracic inlet release (lymphatic drainage), rib raising (T12), paraspinal inhibition (L1-2), and sacral inhibition (S2-4). All techniques except for suboccipital decompression used a respiratory assist mechanism, whereby the patient would be instructed to inhale and exhale, with the osteopathic physician making adjustments after each round to augment lymphatic drainage of the abdomen and pelvis. Suboccipital decompression was preferred over the compression of the fourth ventricle (CV4) technique because it more directly addresses cranial nerve 10 and the parasympathetic outflow to the uterus. The latter technique reduces sympathetic hyperstimulation, which the other techniques in this protocol addressed. Suboccipital decompression has been demonstrated to modulate the effects of CN10, although the exact mechanism with regard to suboccipital decompression and uterine contractions remains undefined. These techniques were performed either supine or lateral recumbent in the respective patient's birthing room guided by patient preference. Total treatment time did not exceed 20 minutes.

Obstetrical Management

Obstetrical decisions regarding labor management were made by a single senior attending osteopathic obstetrician (G.C.A.) and executed by osteopathic obstetricians for the OMT group and allopathic obstetricians for the control group. Osteopathic manipulative treatment was performed when patients were initially admitted to the labor and delivery unit for management of their intrapartum course. When patients reached complete dilation, active pushing was initiated regardless of parity. Latent labor was defined as cervical dilation less than 6 cm, with active labor being defined as cervical dilation greater than or equal to 6 cm. All patients included in this cohort received epidural anesthesia and had intravenous oxytocin administered for augmentation of labor at some point along their labor course. All other obstetrical decisions were made as appropriate and consistent with the American College of Obstetricians and Gynecologists guidelines.

Statistical Analysis

Study outcomes included total labor time, presence of meconium-stained amniotic fluid, and requirement of cesarean delivery due to diagnosis of failure to progress in labor or lack of descent. The Welch 2-sample t test, uncorrected χ² test, and 95% CIs for proportions were calculated using binomial tests as appropriate to
evaluate for statistical significance. A power analysis performed to calculate the required number of patients to achieve 90% statistical power yielded a requirement of 87 patients. Significance was a priori set at \( P < .05 \) and trending findings set at \( P < .10 \). Statistics were performed using the statistical platform R version 3.5.0 (The R Foundation).21

**Results**

The study included 100 patients, with 50 patients in each arm. All patients had complete follow-up and treatment data recorded. The patient population was ethnically diverse. In both the OMT and control groups, the largest proportion of patients were Asian (16 [32%] and 20 [40%], respectively). Patient demographic information included maternal age, whether the patient initially presented in latent labor, parity, and gestational age at time of delivery (Table 1). Obstetrical outcomes are summarized in Table 2. Total labor duration in the OMT vs control group resulted in 11.34 (6.62) (range, 1.1-27.0) hours vs 16.57 (4.39) (range, 1.0-58.8) hours, respectively (\( P = .03 \)). All other measures did not achieve statistical significance, including total labor times when divided between primiparous and multiparous patients, presence of meconium-stained amniotic fluid, and the need for cesarean delivery. This finding was not surprising because neither group achieved the threshold of 87 patients required by the power analysis.

Ninety percent of patients in the OMT group had positive Chapman points for the uterus, and 100% had positive Chapman points for the broad ligament before delivery. After delivery, 30% of patients had positive uterine Chapman points, and 5% had positive Chapman points for the broad ligament.

**Discussion**

To our knowledge, this study is the first to present an effective, efficient, and feasible approach to osteopathic obstetrical management in the inpatient setting.

<table>
<thead>
<tr>
<th>Maternal Demographics</th>
<th>OMT (n=50)</th>
<th>Control (n=50)</th>
<th>( P ) Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maternal Age, y, mean (range)</td>
<td>28 (18-39)</td>
<td>28 (19-38)</td>
<td>.65</td>
</tr>
<tr>
<td>Maternal Age &gt;34 y</td>
<td>4 (8)</td>
<td>6 (12)</td>
<td>.51</td>
</tr>
<tr>
<td>Latent Labor</td>
<td>31 (62)</td>
<td>37 (74)</td>
<td>.06</td>
</tr>
<tr>
<td>Nulliparous</td>
<td>24 (48)</td>
<td>24 (48)</td>
<td>&gt;.99</td>
</tr>
<tr>
<td>Gestational Age at Delivery, wk, mean (SD)</td>
<td>39.1 (1.6) (range, 34-41)</td>
<td>39 (1.2) (range, 36-42)</td>
<td>.09</td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asian</td>
<td>6 (12)</td>
<td>10 (20)</td>
<td>.09</td>
</tr>
<tr>
<td>Black</td>
<td>8 (16)</td>
<td>4 (8)</td>
<td>.12</td>
</tr>
<tr>
<td>Hispanic</td>
<td>16 (32)</td>
<td>20 (40)</td>
<td>.06</td>
</tr>
<tr>
<td>Middle Eastern</td>
<td>8 (16)</td>
<td>5 (10)</td>
<td>.45</td>
</tr>
<tr>
<td>White</td>
<td>12 (24)</td>
<td>11 (22)</td>
<td>.93</td>
</tr>
</tbody>
</table>

\( \text{Abbreviation: OMT, osteopathic manipulative treatment.} \)
As previously described, pregnancy and labor present many challenges to the musculoskeletal and neurovisceral framework; thus, our protocol was devised to focus on these components. Limiting the protocol to address these issues in an approach analogous to pharmacologic minimum effective concentration was found to yield an effective and feasible approach to osteopathic obstetrical care in the inpatient setting. Osteopathic obstetrical care is not a standard approach and is limited by the traditional labor setting. Although we concede that a more ideal setting and increased duration of treatment would be preferred to our current approach, it is not always feasible. However, it is paramount that a framework be defined to allow for the practical and effective implementation of osteopathic obstetrical management of obstetric patients. From the preliminary results presented in this report, the authors conclude that this framework allows for such an execution.

### Comparison With Previous Research

A comparison of the specifics of previous research with this current research is summarized in Table 3. As mentioned, the current research to which a relationship between OMT and labor duration has been explored seems to be limited to 3 studies: Hart,3 Whiting,4 and Hensel et al.5 Hart3 and Whiting4 demonstrated a decreased labor duration for women who received prenatal OMT, whereas Hensel et al.5 demonstrated a prolonged labor duration.

Hart3 found that the average duration of labor among the 100 women studied was 9 hours and 20 minutes for primiparous women and 5 hours for multiparous women, compared with 15 hours and 9 hours, respectively, for women who did not receive prenatal OMT. A key aspect of Hart’s study is that it describes a complete approach to osteopathic obstetrics at each stage of labor, namely, antepartum, intrapartum, and postpartum. For the purposes of this discussion, Hart’s

### Table 2: Effect of Osteopathic Obstetrical Management on the Duration of Labor: Outcomes Among the OMT and Control Groups

<table>
<thead>
<tr>
<th>Labor Component</th>
<th>OMT (n=50)</th>
<th>Control (n=50)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>All Patients</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total labor time, mean (SD)</td>
<td>11.34 (6.62) (range, 1.1-27.0)</td>
<td>16.57 (4.39) (range, 1.0-58.8)</td>
<td>.03</td>
</tr>
<tr>
<td>MSAF</td>
<td>11 (22)</td>
<td>9 (18)</td>
<td>.62</td>
</tr>
<tr>
<td>Cesarean delivery</td>
<td>3 (6)</td>
<td>5 (10)</td>
<td>.47</td>
</tr>
<tr>
<td><strong>Primiparous Patients</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total labor time, mean (SD)</td>
<td>11.39 (5.2) (range, 2.33-20.6)</td>
<td>15.05 (12.8) (range, 1.12-54.7)</td>
<td>.41</td>
</tr>
<tr>
<td>MSAF</td>
<td>8 (33.3)</td>
<td>5 (20.8)</td>
<td>.34</td>
</tr>
<tr>
<td>Cesarean delivery</td>
<td>1 (4.2)</td>
<td>2 (8.3)</td>
<td>.56</td>
</tr>
<tr>
<td><strong>Multiparous Patients</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total labor time, mean (SD)</td>
<td>10.5 (8.07) (range, 1.07-27.0)</td>
<td>18.1 (16.2) (range, 1.0-58.8)</td>
<td>.10</td>
</tr>
<tr>
<td>MSAF</td>
<td>3 (12.5)</td>
<td>4 (16.7)</td>
<td>.69</td>
</tr>
<tr>
<td>Cesarean delivery</td>
<td>2 (8.3)</td>
<td>3 (12.5)</td>
<td>.65</td>
</tr>
</tbody>
</table>

* Data are presented as No. (%) unless otherwise indicated.

**Abbreviations:** MSAF, meconium-stained amniotic fluid; OMT, osteopathic manipulative treatment.
antepartum and intrapartum management and resultant effects on labor duration are important. He initially describes how “preparatory treatments” were used to reduce the time of labor and lessen if not eliminate sacral pain. This terminology of preparatory treatment is analogous to the modern terminology of prenatal treatment and thus makes his study more analogous to the methods of Hensel et al. The prenatal treatments were initiated in the third trimester at 8 months. The technique itself involved spinal treatment to the lumbo-sacral region and sacroiliac articulation in addition to manipulation of the large bowel. Hart also describes a technique used during the intrapartum period consisting of a combined use of chloroform and OMT through which he asserted was a novel way to shorten labor duration. This method may be analogous to modern day practice in which epidural anesthesia produces a net reduction in labor duration. The OMT procedures along with the administration of chloroform-soaked gauze involved continuous massage of the uterine body and fundus toward the pelvic outlet between uterine contractions. This approach has similarities with our present investigation in that we administered OMT in tandem with epidural anesthesia, so the 2 interventions may have an additive or synergistic effect. This approach, Hart explicitly states, can be fatiguing and requires the physician to be continuously by the side of the patient, but it has the added benefits of a shorter labor and increased opportunity for encouragement and support of the patient.

Whiting found that the average labor time for primiparous women who received prenatal OMT was 9 hours and 54 minutes, compared with 21 hours and 6 minutes for primiparous women who did not receive OMT. Labor time for multiparous women who received prenatal OMT was 6 hours and 19 minutes, compared with 11 hours and 41 minutes for multiparous women who did not receive prenatal OMT. Whiting was the primary obstetrician for the women in her study, although the exact setting is not described. Hensel et al did not report labor duration in terms of hours and minutes given lack of consistent reporting. Labor duration was instead determined by a diagnosis of prolonged labor defined as labor lasting more than 20 hours. The study included 400 women, with random assignment of 129 patients who received OMT, 122 who received placebo ultrasound treatment, and 129 who received usual care only. Women who received OMT were 2.3 times more likely to experience prolonged labor compared with participants in the usual care only group (95% CI, 1.10-4.89; \( P = .028 \)) and 4 times more likely to experience prolonged labor compared with participants in the placebo ultrasound treatment group (95% CI, 1.70-9.84; \( P = .002 \)). Participants in the placebo ultrasound treatment and usual care only groups showed no significant difference in

### Table 3.
Literature Review for Previous Studies on the Effects of OMT in Labor and Delivery

<table>
<thead>
<tr>
<th>Study</th>
<th>Effect of OMT on Labor Duration</th>
<th>Reported Analgesia, No.</th>
<th>Timing of OMT in Pregnancy</th>
<th>Osteopathic and Obstetrical Providers</th>
<th>Significant Statistical Analysis Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whiting(^4)</td>
<td>Decreased</td>
<td>Not reported</td>
<td>Intrapartum</td>
<td>Same providers</td>
<td>Not performed</td>
</tr>
<tr>
<td>Hart(^3)</td>
<td>Decreased</td>
<td>91 patients</td>
<td>Antepartum and Intrapartum</td>
<td>Same providers</td>
<td>Not performed</td>
</tr>
<tr>
<td>Hensel et al(^5)</td>
<td>Increased</td>
<td>Not reported</td>
<td>Antepartum</td>
<td>Different providers</td>
<td>Yes</td>
</tr>
<tr>
<td>Martingano et al(^22)</td>
<td>Decreased</td>
<td>100 patients</td>
<td>Intrapartum</td>
<td>Same providers</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Abbreviation: OMT, osteopathic manipulative treatment.
likelihood to experience prolonged labor ($P=.23$). The OMT protocol included prenatal treatments for a total of 7 visits in the third trimester, specifically at 30, 32, 34, 36, 37, 38, and 39 weeks of gestation. Each visit lasted 20 minutes and involved the following techniques: seated forward-leaning thoracic spine articulator; supine cervical soft tissue myofascial release (MFR), occipitotentorial decompression, thoracic inlet MFR, lateral recumbent scapulothoracic MFR, lumbosacral soft tissue, abdominal diaphragm MFR, pelvic diaphragm MFR, sacroliliac articulation, frog-leg sacral release, pubic symphysis decompression, and compression of the fourth ventricle. Obstetrical outcomes were retrospectively reviewed through medical records.

**Defining Modern Intrapartum Osteopathic Obstetrical Management**

The present study proposes a modern intrapartum osteopathic obstetrical management framework that has yet to be described. Taking the aforementioned information presented in the review of the literature, it is seen that the 2 studies that demonstrated a reduction in labor duration involved an intrapartum OMT component, whereas the remaining study that showed a prolonged labor did not. It can be postulated that an intrapartum OMT component is necessary for a shortened labor duration. Hart’s approach involves a prenatal component as well as an intrapartum component in tandem with analgesia, to which he states contributed in a significant way to the reduction of the labor duration. In the present study, all patients received epidural anesthesia in addition to OMT, which draws a parallel to the intrapartum component of Hart’s approach and may have added to the resulting reduction in labor duration in both studies. In addition, we do not expect the viscero-somatic reflex interplay of the pelvic viscera and its autonomic exchange to be disrupted or altered in any way secondary to the administration of epidural anesthesia based on the results of a study by Martingano et al. This study demonstrated a preservation of the viscero-somatic reflex even after administration of regional analgesia with spinal blocks during elective bilateral tubal ligations, which are similar to epidural anesthesia given during labor but at a much higher dose. Regional analgesia itself can alter labor duration. A randomized study of intrathecal opioids vs systemic opioids found the first stage of labor to be 90 minutes shorter in women receiving intrathecal rather than systemic opioids. A meta-analysis of randomized clinical trials comparing epidural with no epidural analgesia during labor found that epidural analgesia prolonged the second stage of labor by a mean difference of 13.66 minutes. These studies seemed to demonstrated a net reduction in labor duration from the administration of epidural anesthesia and concomitant OMT during labor. Another possible explanation for the opposing outcomes of labor duration in the studies by Hart, Whiting, and Hensel may be that OMT was not performed by the same physician who managed the labor and delivery for the patients in the study by Hensel et al. Hart, Whiting, and the present study all had OMT provided by the delivering osteopathic obstetrician in addition to having obstetrical decision-making performed by the same osteopathic obstetrician.

**Limitations**

Because this study was underpowered to divide the groups into primiparous and multiparous patients, we were only able to conclude a reduction in labor duration for the entire group. This study is ongoing and once enough power is reached, more definitive conclusions will be made. Because of the heterogeneity of the settings even within the inpatient setting, the conclusions of this work may be limited to our urban population and hospital system, despite what comparisons were attempted to be made to the previous studies. Our study’s design involved women receiving epidural analgesia and oxytocin for labor augmentation at some point, which limits our conclusion to that cohort.

**Conclusion**

Pregnancy and labor present many musculoskeletal and neurovisceral challenges to obstetrical patients. To our
knowledge, this is the first study to present an effective, efficient, and feasible approach defining intrapartum osteopathic obstetrical management in the inpatient setting to reduce labor duration. In decreasing labor duration, patients may experience shorter periods of labor-induced discomfort/pain, a reduction in complications associated with prolonged labor, and a shorter hospital stay. As further studies are performed, a more complete definition of osteopathic obstetrical management can be defined, with the present study providing a foundation for its intrapartum component.

Author Contributions
All authors provided substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data; all authors drafted the article or revised it critically for important intellectual content; all authors gave final approval of the version of the article to be published; and all authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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