JOURNAL OF
CONTEMPORARY MEDICINE

DOI:10.16899/jcm.1786925
J Contemp Med 2026;16(1):13-17

Original Article / Orijinal Araştırma

The Effect of the Combined Use of Methylergometrine and Oxytocin During Cesarean Section in the Prevention of Post-Partum Hemorrhage

Sezaryen Sırasında Metilergometrin ve Oksitosinin Birlikte Kullanımının Doğum Sonrası Kanamayı Önlemedeki Etkisi

Necdet Öncü, Ali Buhur

Department of Gynecology and Obstetrics, Istanbul Kanuni Sultan Süleyman Training and Research Hospital, Istanbul, Turkiye

Abstract

Aims: Interest in complementary and alternative medicine (CAM) has been increasing worldwide and in Turkey. We aimed to evaluate the prevalence, types, determinants and perceived effects of CAM use among children with neurological disorders, and to compare our findings with the literature.

Material and Method: This cross-sectional study included 753 children aged 0–18 years who attended a pediatric neurology outpatient clinic between January 2011 and February 2013. Data were collected using a structured face-to-face questionnaire covering sociodemographic characteristics, neurological diagnoses, CAM methods (type and frequency), reasons for use, perceived benefits and adverse effects. Descriptive statistics and chi-square tests were used ($p<0.05$).

Results: CAM use was reported by 58% of participants. The most frequently used methods were mind–body practices (55.8%), biologically based therapies (42.3%) and manipulative/body-based methods (19.0%). Higher paternal educational level, multiple neurological diagnoses and frequent outpatient visits were associated with CAM use ($p<0.05$). CAM use was most common among children with cerebral palsy (81.3%), specific learning disorder (70.8%) and developmental delay (69.2%). Nearly half of families (47.6%) perceived benefit, and adverse effects were reported in 1.8% of users (all mild).

Conclusion: CAM use is common among children with neurological disorders and is often used alongside conventional treatment. Although families frequently perceive benefit, evidence for many modalities remains limited, and some biologically based treatments may pose drug–interaction risks. Clinicians should ask routinely about CAM use, provide evidence-based guidance and consider potential interactions. Further controlled studies are needed in pediatric neurology.

Keywords: Complementary and alternative medicine, pediatric neurology, epilepsy, cerebral palsy, herbal medicine, mind–body therapies

Öz

Amaç: Son yıllarda tüm dünyada ve ülkemizde tamamlayıcı ve alternatif tedavi (TAT) yöntemlerine olan ilgi giderek artmaktadır. Nörolojik bozuklukları olan çocuklarda TAT kullanımının yaygınlığını, türlerini, belirleyicilerini ve etkilerini değerlendirmek ve bulguları mevcut literatürle karşılaştırmak.

Gereç ve Yöntem: Bu kesitsel çalışmaya, Ocak 2011 ile Şubat 2013 tarihleri arasında çocuk nöroloji polikliniğine başvuran 0-18 yaş arası 753 çocuk dahil edildi. Veriler, sosyodemografik özellikler, nörolojik tanılar, TAT kullanım türleri ve sıklığı, kullanım nedenleri, faydalar ve yan etkilerini inceleyen yüz yüze uygulanmış bir anket kullanılarak toplandı. Tanımlayıcı istatistikler ve ki-kare testleri yapıldı ve $p<0,05$ anlamlılık düzeyi kabul edildi.

Bulgular: Katılımcıların %58'inde TAT kullanımı bildirildi. En sık kullanılan yöntemler zihin-beden uygulamaları (%55,8), biyolojik temelli terapiler (%42,3) ve manipülatif/beden temelli yöntemler (%19) idi. Daha yüksek baba eğitim düzeyi, çoklu nörolojik tanılar ve sık poliklinik ziyaretleri, TAT kullanımıyla anlamlı derecede ilişkiliydi ($p<0,05$). TAT kullanımı en çok serebral palsili (%81,3), öğrenme güçlüğü olan (%70,8) ve gelişimsel gecikmesi olan (%69,2) çocuklarda yaygındı. Ailelerin neredeyse yarısı (%47,6) fayda sağlandığını bildirirken, kullanıcıların %1,8'inde bazı yan etkiler bildirildi ve bunların tümü hafifti.

Sonuç: TAT kullanımı, nörolojik bozuklukları olan çocuklar arasında oldukça yaygındır ve genellikle geleneksel tıbbi tedavinin yanında tamamlayıcı bir yaklaşım olarak kullanılır. Aileler sıklıkla fayda görse de, çoğu TAT yöntemini destekleyen bilimsel kanıtlar sınırlıdır ve bazı biyolojik temelli tedaviler ilaç etkileşimi riskleri oluşturabilir. Klinisyenler rutin olarak TAT kullanımı hakkında bilgi edinmeli, aileleri kanıta dayalı bilgilerle yönlendirmeli ve yönetim sırasında potansiyel etkileşimleri göz önünde bulundurmalıdır. Pediatrik nörolojide TAT yöntemlerinin güvenliği ve etkinliğini değerlendirmek için daha fazla kontrollü çalışmaya ihtiyaç vardır.

Anahtar Kelimeler: Tamamlayıcı ve alternatif tıp, pediatrik nöroloji, epilepsi, serebral palsi, bitkisel tıp, zihin-beden terapileri

Corresponding *(İletişim)*: Necdet Öncü, Department of Gynecology and Obstetrics, Istanbul Kanuni Sultan Süleyman Training and Research Hospital, Istanbul, Turkey
E-mail *(E-posta)*: necdetoncu@hotmail.com
Received *(Geliş Tarihi)*: 18.09.2025 **Accepted *(Kabul Tarihi)*:** 14.01.2026

INTRODUCTION

There has been a growing preference for cesarean sections in recent years. This trend has rendered indications for cesarean sections, as well as their effects on both mothers and infants, a significant social issue warranting thorough examination. [1] Postpartum hemorrhage (PPH) is an important factor in maternal morbidity and mortality worldwide, with uterine atony identified as the predominant cause of PPH.[2] The incidence of PPH appears to be increasing globally, prompting more research on its prevention.[3] The increase in post-partum hemorrhage frequency worldwide has led to a rise in the number of published studies on its prevention.[4] Manual uterine massage and oxytocin are the first-line treatments of choice for PPH. However, there is no agreement regarding the superiority of one treatment over another for prevention.[5] Oxytocin is a hormone released by the posterior pituitary gland that stimulates myometrial contractility by increasing intracellular calcium concentration.[6] Calcium engages with calmodulin to activate myosin light-chain kinase, which constitutes the primary mechanism of contraction in uterine smooth muscle.[7] It is frequently administered as an IV bolus followed by an infusion to sustain adequate uterine tone owing to its short plasma half-life (3–12 min).[8] Methylergonovine: a serotonergic receptor agonist in smooth muscle that causes uterotonic effects by activating α-adrenergic and serotonin receptors in the myometrium.[9] Tranexamic acid (TXA): A non-anticoagulant medication that inhibits fibrinolysis and reduces blood clot breakdown.[10] Carbetocin: A long-acting synthetic analog of oxytocin with a terminal half-life of approximately 40 min.[11] Misoprostol: A synthetic analog of prostaglandin E1 is used to induce labor and manage postpartum hemorrhage.[12] Oxytocin and methylergonovine are uterotonic agents that can help prevent PPH; however, they have different mechanisms of action. Oxytocin increases intracellular calcium to stimulate myometrial contractions, while methylergonovine acts on serotonergic and adrenergic receptors. The combined use of oxytocin and methylergometrine may be more effective in preventing PPH than oxytocin alone, as the two agents could have a synergistic effect.

Therapeutic interventions can be employed independently or in combination. Currently, there is no consensus regarding treatment tactics or the superiority of one therapeutic approach over another, especially in the prevention of postpartum hemorrhage.

This study aimed to assess the efficacy of oxytocin compared with the combined administration of oxytocin and methylergometrine in preventing postpartum hemorrhage in cesarean sections.

MATERIAL AND METHOD

Study Population and Ethics

This retrospective study was conducted on 1292 female patients aged between 18 and 35 years at the Istanbul Kanuni Sultan Suleyman Training and Research Hospital from January 2022 to December 2022. The study has been granted ethics approval by the Istanbul Kanuni Sultan Suleyman Training and Research Hospital, fully adhering to the 2013 Declaration of Helsinki, under application number 2023.06.84. This study was conducted retrospectively, so patient consent was not required for participation or publication, as there was no direct contact between the authors and patients. Informed consent was obtained from all patients before cesarean section. Participants were randomly assigned to two groups according to the chronological order of their birth. (Fig. 1 flow diagram). Group 1 (n=200) received oxytocin before placental extraction, and group 2 (n=200) was administered a combination of oxytocin and methylergometrine.

Inclusion criteria: 1) Women aged 18 - 35 years. 2)- Women who had undergone cesarean section to give birth under spinal anesthesia. 3)- Gestational age between 38 and 40 weeks. 4)- Women with no risk factors for developing atonic postpartum hemorrhage. 5)- Women had no severe metabolic disorders or coagulopathy.

Exclusion criteria: 1. Gestational age less than 38 weeks. 2. women who delivered vaginally 3. The woman had known allergies to oxytocin and methylergometrine. 4. The women had severe metabolic disorders or coagulopathy 5. Women had placental abnormalities such as placenta previa, placental adhesive disorder, and placental abruption. 6. In the combined group, 87women who needed additional uterotonic

Sample Size Determination

The G* Power 3.1 statistical program was used to determine the sample size. The calculations were grounded in essential assumptions: a 95% confidence level, 80% power, and a 1:1 ratio of participants in the oxytocin group compared to the combined group. This study comprised a total of 1,292 participants, with 670 assigned to the oxytocin group and 622 to the combined group. Notably, the largest sample size referenced in this research was sourced from a prominent study conducted in Turkey13.

Intervention

Cesarean sections in both groups were performed under spinal anesthesia by the same group of surgeons. Each delivery involved a Pfannenstiel incision for abdominal access. The fetus was extracted via a transverse uterine incision, quickly clamped, and the umbilical cord was cut; the placenta was extracted using manual traction techniques. Oxytocin (Synpitan forte; Deva Pharma, Istanbul, Turkiye)was administered via intravenous infusion of 20 units in 500 mL of lactated Ringer's solution at a rate of 333 mL per hour in the operating room before delivery of the placenta in the postoperative period and both groups received 20 units of medication in 1000 mL of lactated Ringer's solution, administered at a rate of 333 mL per hour. The second group received intramuscular doses of oxytocin and methylergometrine (Metiler Adeka, Istanbul, Turkiye) immediately after placental delivery. A second dose was administered three hours later to ensure the benefits of its long-lasting effects. The amount of blood lost during the cesarean section procedure was measured using suction bottle contents and blood-soaked materials. The primary outcome measures included postpartum hemorrhage (PPH), assessed through the evaluation of changes in preoperative and postoperative

hemoglobin and hematocrit levels, as well as intraoperative blood loss. Secondary outcomes included the application of additional intraoperative hemostatic uterine sutures, duration of the surgical procedure, necessity for supplementary uterotonics, and requirement for blood transfusion.

Statistical Analysis

Statistical analyses were conducted with SPSS for Windows 24 (SPSS Inc., Chicago, IL, USA). To evaluate the study data, descriptive statistics (mean, standard deviation, count, and percentage) were compared using a Student's t-test for normally distributed parameters and a Mann–Whitney U-test for non-normally distributed ones. A paired samples t-test was employed to compare parameters having a normal distribution before and after the surgery. The criterion for statistical significance was established at $P<0.05$.

RESULTS

A total of 1405 patients joined the study. However, 215 women were excluded before randomization for several reasons: 60 had preterm pregnancies, 32 had incomplete data, 28 had metabolic problems or coagulopathy, and 8 had placental disorders. In the combined group, 87 women who need additional uterotonic. Thus, the study was conducted using data from 1205 women, evenly divided into two groups: 670 patients in Group 1 and 535 in Group 2. All patients remained included post-randomization. **Figure 1** illustrates a flow diagram of the study. **Table 1** presents the fundamental demographic and obstetric features of the patients across the categories. The results indicated no statistically significant differences among the groups in terms of the mean BMI, age, gestational age, gravida, and parity. **Table 2** presents the indications for cesarean sections in the two groups. The most prevalent indication in both groups was a previous cesarean section, p=0.344. **Table 3** compares intra- and post-operative outcomes between groups.

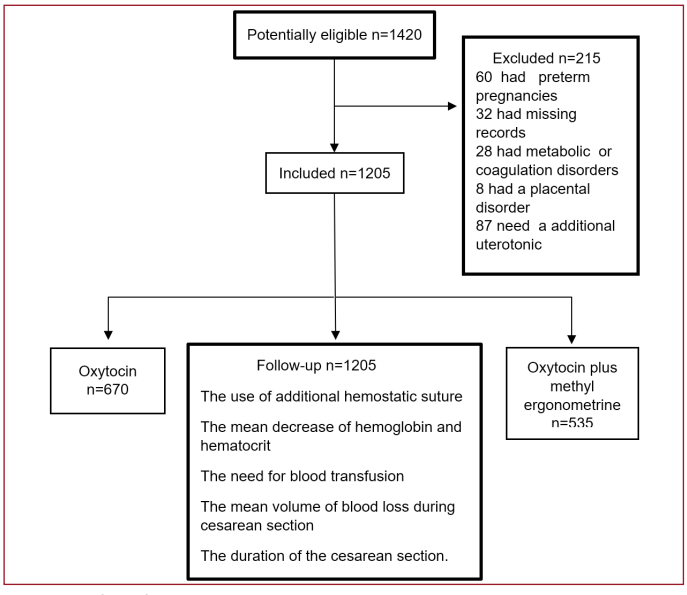

Figure 1. Flow diagram

Table 1: Demographic characteristics

Demographic characteristics	Group 1 (n=200)	Group 2 (n=200)	p value
Age (years)	28.46±3.24	29.02±1.23	0.561
Body mass index(kg/m2	31.26±3.24	32.62±4.20	0.583
Gravida	2.02±46	2.34±35	0.352
Parity	1.56±093	1.65±0.47	0.702
Gestational age	271.35±2.22	268.71±2.67	0.654

Table 2: Indications of cesarean section

Indications	Group 1 (n=670) %	Group 2 (n=622 %	p value
Previous cesarean section	(340) 50.7 %	(320) 51.4 %	0.344
Fetal distress	(112) 16.7%	(109)17. 5) %	0.223
Malpresentation	(20) 3.0 %	(17)2.7%	0.618
Macrosomia	(24)3.6 %	(20) 3.2%	0.618
Failure of the progress of labor	(80) 11.9%	(70) 11.6%	0.661
Others	(94) 14%	(86)13.8%	0.517

Table 3 Operative characteristics

Operative characteristics	Group 1 (n=670)	Group 2 (n=622)	p value
Pre-operative hemoglobin(g/dl)	10.81±0.93	11.19±0.93	0.275
Pre-operative hemotocrit(%)	31.21±1.61	33.17±2.1	0.128
Post-operative hemoglobin(g/dl	8.53±1.11	10.31±1.20	0.001*
Post-operative hemotocrit(%)	24.84±2.34	30.87±0.76	0.001*
Operating time	46.48±6.17	49.24±4.86	0.923
Intraoperative blood loss	620.42±70.06	440.80±56.31	0.002*
Need for blood transfusion	3.1% (21)	2.9% (18)	0.843
Need for additional uterotonics	27.2%(182)	13.9% (87)	0.005*
Need for additional suture	7.5% (50)	7.1% (44)	0.743

No serious adverse drug effects were observed in any of the groups. No significant postoperative complications occurred in any of the groups. There were no significant differences between the groups in terms of operating time, blood transfusion requirements, or the need for additional hemostatic sutures.

There were significant differences in the need for additional uterotonics, 27.2% (182), 13.9% (87), p=0.005, the change in pre-and postoperative hemoglobin concentration, 10.81±0.93, 8.23±1.11, p=0.001, and hematocrit, 11.89±0.93, 10.31±1.20, p=0.001, and intraoperative blood loss, 620.42±70.06, 440.80±56.31, p=0.002

DISCUSSION

Findings and Interpretation

The study compared the use of oxytocin alone versus a combination of oxytocin and methylergometrine for preventing PPH. The combined use of these agents was found to be more effective in reducing postpartum bleeding in women undergoing cesarean section. Significantly less need for additional uterotonics, lower postoperative drops in hemoglobin and hematocrit levels, and reduced intraoperative blood loss.

In the 2022 network meta-analysis analyzing medical interventions for the prevention of postpartum hemorrhage (PPH) after cesarean delivery, ergometrine alone was inferior to oxytocin in reducing both estimated blood loss and the need for additional uterotonics therapy.[13] The present study also showed that the combined group needed much less uterotonic agent treatment than the oxytocin-only group.

This might be due to the much longer half-life of methylergometrine (138 minutes) when compared to that of oxytocin (1–6 minutes.[14] Mitchell et al.[15] showed that oxytocin plus ergometrine is more effective than oxytocin alone in PPH. Senturk et al.[16] clearly established that the decline in hemoglobin levels during the post-operative period was significantly less pronounced in patients undergoing combined treatment compared to those who did not receive methylergometrine. Postpartum hemorrhage was markedly reduced in the combination of methyl ergometrine and oxytocin groups compared to that in the oxytocin-only group.[17] Nuamsiri et al.[18] observed that the prevention of postpartum hemorrhage with oxytocin compared with ergometrine mixed with oxytocin during the third stage of labor did not yield statistically significant differences in the need for more oxytocin. This is in contrast to the results of the present study. The combination of ergometrine with oxytocin, carbetocin, and misoprostol plus oxytocin showed superior efficacy in reducing postpartum hemorrhage (PPH) by ≥500 ml compared to the usual oxytocin treatment, as indicated in the Cochrane Review 2018.[19] Consistent with our findings, Arunadevi.[20] observed a statistically significant reduction in mean blood loss, indicating that the combined administration of medications was more effective than oxytocin alone. Narayana et al.[21] demonstrated that both oxytocin and methylergometrine are equally effective in preventing postpartum hemorrhage when employed as part of the active management of the third stage of labor

Strengths and Limitations

This study randomized participants into two groups to mitigate bias and enhance reliability.

This comparative design allows for a direct evaluation of the two approaches. The study has limitations, notably its short-term design and its execution at a single tertiary hospital, which may restrict the generalizability of the findings. The study's results and limitations suggest the need for larger, multi-center studies to confirm these findings and potentially influence clinical guidelines for PPH prevention in cesarean sections.

CONCLUSION

Our results indicate that the combined use of these agents was more effective in reducing postpartum bleeding in women undergoing cesarean section. The combined group demonstrated a clear advantage by requiring significantly less uterotonic treatment, experiencing a smaller decrease in hemoglobin and hematocrit levels postoperatively, and losing less blood during the procedure. We recommend the routine use of oxytocin and methylergonovine in cesarean section.

ETHICAL DECLARATIONS

Ethics Committee Approval: Ethical approval was obtained from the Istanbul Kanuni Sultan Suleyman Training and Research Hospital Ethics Committee (Date: 15.06.2023, Decision no: 2023.06.84).
Informed Consent: Written informed consent was obtained from all participants prior to enrollment in the study.
Referee Evaluation Process: Externally peer-reviewed.
Conflict of Interest Statement: The authors have no conflicts of interest to declare.
Financial Disclosure: The author declared that this study has received no financial support.
Author Contributions: All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

REFERENCES

1. Buhur A, Oncu N, Erdem D. Analysis of Caesarean Section Rates with the Robson 10 Group Classification. Turk J Health S. 2022;3(2):53-57.
2. Ramler PI, Akker T, Henriquez DDCA, et al. Women receiving massive transfusion due to postpartum hemorrhage: A comparison over time between two nationwide cohort studies. Acta Obstet Gynecol Scand. 2019;98:795–804.
3. GreeneRA, McKernanJ, ManningE, et al. Major obstetrical haemorrhage: Incidence, management and quality of care in Irish maternity units.Eur J Obstet Gynecol Reprod Biol.2021;257:114–20.
4. Buhur A, Erdem D. Changing trends in cesarean section deliveries in a tertiary hospital using the Robson Ten Group Classification. J Contemp Med. March 2023;13(2):301-4.
5. Vallera C, Choi LO, Cha CM, Hong RW. Uterotonic Medications: Oxytocin, Methylergonovine, Carboprost, Misoprostol. Anesthesiol Clin. 2017;35(2):207-19.
6. Dyer RA, Van Dyk D, Dresner A. The use of uterotonic drugs during caesarean section. Int J Obstet Anesth 2010;19:313–9.
7. Arais F. Pharmacology of oxytocin and prostaglandins. Clin Obstet Gynecol 2000; 43:455–68.
8. Heesen M, Carvalho B, Carvalho JCA, et al. International consensus statement onthe use of uterotonic agents during caesarean section. Anaesthesia. 2019;74:1305–19.
9. Bateman BT, Tsen LC, Liu J, et al. Patterns of second-line uterotonic use in a large sample of hospitalizations for childbirth in the United States: 2007-2011. Anesth Analg. 2014;119(6):1344–9.
10. Grassin-Delyle S, Semeraro M, Lamy E, et al. Pharmacokinetics of tranexamic acid after intravenous, intramuscular, and oral routes: a prospective, randomized, crossover trial in healthy volunteers. Br J Anaesth 2022;128:465–72.
11. Leduc D, Senikas V, Lalonde AB. No. 235-Active Management of the third stage of labour: prevention and treatment of postpartum hemorrhage. J Obstet Gynaecol Can. 2018;40(12):841-55.
12. Bakker R, Pierce S, Myers D. The role of prostaglandins E1 and E2, dinoprostone, and misoprostol in cervical ripening and the induction of labor: a mechanistic approach. Arch Gynecol Obstet. 2017;296(2):167-79.
13. Şentürk Ş, Kağıtçı M, Balık G, Arslan H, Kır Şahin F. The effect of the combined use of methylergonovine and oxytocin during caesarean section in the prevention of post-partum haemorrhage. Basic Clin Pharmacol Toxicol. 2016;118(5):338-43.
14. Jaffer D, Singh PM, Aslam A, Cahill AG, Palanisamy A, Monks DT. Preventing postpartum hemorrhage after cesarean delivery: a network meta-analysis of available pharmacologic agents. Am J Obstet Gynecol. 2022;226(3):347-65.

15. Schiff PL. Ergot and its alkaloids. Am J Pharm Educ. 2006;70(5):98.
16. Mitchell GG, Elbourne DR. The Salford Third Stage Trial. Oxytocin plus ergometrine versus oxytocin alone in the active management of the third stage of labor. Online J Curr Clin Trials. 1993;Doc No 83:
17. Anvaripour A, Shahryari H, Ahmadi S, Ghasemi S, Mirzaei K. Comparison of the effects of oxytocin and methylergonovine in elective caesarean section under spinal anesthesia. Arch Gynecol Obstet. 2013;287(5):979-83.
18. Somanathan R, Balu M, Jacob E, Illickal SM. A randomised controlled study for the prevention of post-partum haemorrhage with oxytocin plus methyl ergometrine versus oxytocin alone in the third stage of labour. Int J Reprod Contracept Obstet Gynecol. 2021;10(5):1906-13.
19. Nuamsiri T, Kaewkiattikun K. Prevention of Postpartum Hemorrhage with Oxytocin versus Ergometrine Plus Oxytocin in the third stage of labor. Thai Journal of Obstetrics and Gynaecology. 2016;97:103.
20. Gallos ID, Williams HM, Price MJ, et al. Uterotonic agents for preventing postpartum haemorrhage: a network meta-analysis. Cochrane Database Syst Rev. 2018;4(4):CD011689.
21. Aruna Devi V. Comparative efficacy of syntometrine versus oxytocin in active management of third stage of labour." PhD diss., Madras Medical College, Chennai, 2010.
22. Narayana D, Pathak B, Khurana A, Kohli UA. Intramuscular oxytocin 10 units versus intravenous methylergometrine 0.2 mg in active management of the third stage of labour for prevention of postpartum haemorrhage: a comparative study. Int J Reprod Contracept Obstet Gynecol 2020;9:494-8.