



## **Oxytocin during cesarean section delivery (A Review)**

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### **Abstract**

Oxytocin increases the permeability of the uterus myofibrils to sodium and stimulates the contraction of the smooth muscle of the uterus indirectly, but the inappropriate dose of this compound may cause a wide range of complications, including cardiovascular system disorders (hypotension, increased heart rate, increased venous return and cardiac output). Currently, for women with cesarean section, 5 units of intravenous oxytocin are used to strengthen uterine contractions and, thereby, reduce bleeding, which in some cases can lead to widespread complications. Searches were conducted by two independent researchers in international (PubMed, Web of science, Scopus and Google scholar) and national (SID, Magiran) databases for related studies from the inception of the databases to September 2017 (without time limitation) in English and Persian languages. To ensure literature saturation, the reference lists of included studies or relevant reviews identified through the search were scanned. The specific search strategies were created by a Health Sciences Librarian with expertise in systematic review search using the MESH terms and free terms according to the PRESS standard. During caesarean section delivery, oxytocin is commonly prescribed, so that after delivery with sufficient uterine contractions and maintaining these contractions, the amount of bleeding is reduced and severe postpartum hemorrhage is prevented. However, there may be adverse side effects in the patient's hemodynamics following the administration of oxytocin, including hypotension, tachycardia, and ECG changes. Given that less oxytocin doses reduce the risk of side effects, efforts are made to reduce the risk of side effects by using the minimum amount of oxytocin that retains the tone of the uterus.

**Keywords:** Oxytocin , cesarean , Review

### **Introduction**

Postpartum hemorrhage is one of the major causes of maternal deaths around the world. According to World Health Organization statistics, 585,000 women died annually due to pregnancy-related factors, of which 25% are due to severe bleeding. A large number of birth centers use oxytocin as the first line of treatment for preventing uterine atony in childbirth (1).

Oxytocin increases the permeability of the uterus myofibrils to sodium and stimulates the contraction of the smooth muscle of the uterus indirectly, but the inappropriate dose of this compound may cause a wide range of complications, including cardiovascular

system disorders (hypotension, increased heart rate, increased venous return and cardiac output) (2). Currently, for women with cesarean section, 5 units of intravenous oxytocin are used to strengthen uterine contractions and, thereby, reduce bleeding, which in some cases can lead to widespread complications (3). Ultimately, as it is mentioned, during caesarean section delivery, oxytocin is commonly prescribed, so that after delivery with sufficient uterine contractions and maintaining these contractions, the amount of bleeding is reduced and severe postpartum hemorrhage is prevented. However, there may be adverse side effects in the patient's hemodynamics

following the administration of oxytocin, including hypotension, tachycardia, and ECG changes (4). Given that less oxytocin doses reduce the risk of side effects, efforts are made to reduce the risk of side effects by using the minimum amount of oxytocin that retains the tone of the uterus.

## Methods

### Search strategy

Searches were conducted by two independent researchers in international (PubMed, Web of science, Scopus and Google scholar) and national (SID, Magiran) databases for related studies from the inception of the databases to September 2017 (without time limitation) in English and Persian languages. To ensure literature saturation, the reference lists of included studies or relevant reviews identified through the search were scanned. The specific search strategies were created by a Health Sciences Librarian with expertise in systematic review search using the MESH terms and free terms according to the PRESS standard. After the MEDLINE strategy was finalized, it was adapted to search in other databases. Accordingly, PROSPERO was searched for ongoing or recently related completed systematic reviews. The key words used in the search strategy were "Oxytocin, cesarean" and Iran which were combined with Boolean operators including AND, OR, and NOT.

### Study selection

Results of the Literature review were exported to Endnote. Prior to the formal screening process, a calibration exercise was undertaken to pilot and refine the screening. Formal screening process of titles and abstracts were conducted by two researchers according to the eligibility criteria, and consensus method was used for solving controversies among the two researchers. The full text was obtained for all titles that met the inclusion criteria. Additional information was retrieved from the study authors in order to resolve queries regarding the eligibility criteria. The reasons for the exclusion criteria were recorded. Neither of the review authors was blinded to the journal titles, the study authors or institutions.

### Cesarean section

Caesarean section is an abnormal type of delivery in which the baby is removed by the shear in the abdominal wall and the mother's womb. In special

circumstances, when a pregnant woman is unable to have a natural delivery for medical reasons, cesarean section, which is a type of surgery, is used to give birth (6).

Since cesarean delivery is less painful for pregnant women, this kind of delivery is very common and many pregnant women are willing to use this method. Although the World Health Organization recommends a maximum of 15% of births by cesarean section, the prevalence of cesarean delivery in many countries is more than this, as about 30% of births in the United States and 46% of births in China. In Iran, there is also an increasing tendency towards the birth of a baby through cesarean section. After Brazil, Iran is the second largest country with the highest rates of cesarean section, and Mexico is in the third place. Austria and the Netherlands are recognized as countries with the lowest (15%) cesarean section rate (7-9).

### Cesarean Indications (10):

- If the person has already had cesarean section.
  - Meconium excretion in the womb
  - Placenta previa
  - Vasa previa
  - The manifestation of umbilical cord
  - Fetal distress over 24 weeks of age
  - Dystocia of childbirth (such as stopping labor, mismatched fetal head with the pelvic floor)
  - Cord prolapse
  - Genital herpes
  - Twins when the first embryo is not born with his head first.
  - Menamenion twins
  - An embryo larger than 4.5 kilograms
  - Uterine abnormalities (Bicornuate uterus)
  - Frequently case of breech presentation
- Complications of cesarean section

### Oxytocin

Oxytocin is a peptide hormone and neuropeptide. Oxytocin is normally produced by the paraventricular nucleus of the hypothalamus and released by the posterior pituitary. It plays a role in social bonding, sexual reproduction in both sexes, and during and after childbirth. Studies have also shown that oxytocin is involved in many behaviors such as orgasm, social recognition, coupling, anxiety, and maternal behaviors (11).

Oxytocin is also available as a medicine under trade names of oxytype, pitosin and syntocinon, which are administered as 5 units per cc (one cc) and 10 units per cubic centimeter; it is used to stimulate uterine contractions and the secretion of milk and suppress postpartum hemorrhage (12).

**The mechanism by which oxytocin implements its effect consists of two cases:**

1. This medication increases the permeability of uterus myofibrils to sodium and stimulates the contraction of the smooth muscles of the uterus indirectly.
2. It facilitates the secretion of milk through affecting myoepithelial cells.

Studies have been conducted to determine the proper dosage of oxytocin to reduce bleeding in the delivery process, including a study conducted by the Anesthesiology Department at Stanford University School of Medicine. The aim of this study was to determine the lowest effective oxytocin dose for producing uterine tone during cesarean section delivery. In this study, the groups receiving 3 and 5 units of oxytocin experienced significant in the production of uterine tone in 2 and 3 minutes in comparison with those subjects who did not receive the medication. Also, the prevalence of hypotension after 5 units of oxytocin versus 0 units per minute was significantly higher. Eventually, this group did not recommend the use of regular 5 units of oxytocin in the elective cesarean section delivery due to the formation of appropriate uterine tone with lower doses of oxytocin (0.3-5 units) (13).

The results of Bhattacharya et al study, which was conducted to compare hemodynamic effects (heart rate, mean blood pressure, arrhythmia), uterine contractions and side effects (chest pain, hot flashes, nausea and vomiting) of oxytocin in two forms of bolus versus intravenous infusion, indicated that in elective cesarean, slow injection of oxytocin is better for producing sufficient uterine contraction with lateral hemodynamic changes in comparison with the bolus form of administration (14). Sartain et al also conducted a randomized, double-blind trial in order to determine the optimal dose of oxytocin with the least adverse cardiovascular effects in cesarean section (cardiac palpitations and hypotension). This study, also, considers the fact that an inadequate dose could increase uterine bleeding. Accordingly, the researchers examined changes in heart rate compared

with mean arterial pressure, blood loss, uterus tone and other symptoms, such as vomiting, caused by the intravenous oxytocin bolus injection, with two doses of 2 and 5 units, in 80 patients undergoing elective cesarean section, examines, tonsil; they eventually concluded that injection of 2 units of bolus oxytocin is associated with hemodynamic changes and less nausea compared to 5-unit injection (15).

Thomas et al conducted a study to examine the effects of bolus and intravenous injection of oxytocin in patients undergoing cesarean section; they intended to reduce the risk and complications of cardiovascular oxytocin in women undergoing cesarean section (tachycardia, dyspnea blood pressure and cardiac output reduction) while maintaining the benefits of oxytocin in reducing postpartum hemorrhage. 30 women underwent elective cesarean section in their study. Finally, while confirming 5 units of oxytocin as an appropriate dose, it was recommended that 5 units in the bolus form should be used with caution compared to slow injection of the same amount of oxytocin (16).

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