

Postpartum intrauterine device contraception: A review

Shadi Rezai, Pameela Bisram, Hasan Nezam, Ray Mercado, Cassandra E Henderson

Shadi Rezai, Ray Mercado, Cassandra E Henderson, Department of Obstetrics and Gynecology, Lincoln Medical and Mental Health Center, Bronx, NY 10451, United States

Pameela Bisram, St. George's University School of Medicine, Grenada, West Indies

Hasan Nezam, Department of Obstetrics and Gynecology, University of Toledo Medical Center, Toledo, OH 43614, United States

Author contributions: All of the authors contributed significantly to this investigation.

Conflict-of-interest statement: No author has any conflict of interest or financial disclosure to report.

Data sharing statement: Not applicable.

Open-Access: This article is an open-access article which was selected by an in-house editor and fully peer-reviewed by external reviewers. It is distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>

Correspondence to: Cassandra E Henderson, MD, CDE, Director of Maternal Fetal Medicine, Department of Obstetrics and Gynecology, Lincoln Medical and Mental Health Center, 234 East 149th Street, Bronx, NY 10451, United States. cassandra.henderson@nychhc.org
Telephone: +1-718-5795513
Fax: +1-718-5794469

Received: March 30, 2015

Peer-review started: March 31, 2015

First decision: July 10, 2015

Revised: November 2, 2015

Accepted: November 24, 2015

Article in press: November 25, 2015

Published online: February 10, 2016

Abstract

AIM: To review the safety (infection, perforation) and

efficacy (expulsion, continuation rates, pregnancy) of intrauterine device (IUD) insertion in the postpartum period.

METHODS: MEDLINE, PubMed and Google Scholar were searched for randomized controlled trials and prospective cohort studies of IUD insertions at different times during the postpartum period. Time of insertion during the postpartum period was documented specifically, immediate post placenta period (within 10 min), early post placenta period (10 min to 72 h), and delayed/interval period (greater than 6 wk). Other study variables included mode of delivery, vaginal *vs* cesarean, manual *vs* use of ring forceps to insert the IUD.

RESULTS: IUD insertion in the immediate postpartum (within 10 min of placental delivery), early postpartum (10 min up to 72 h) and Interval/Delayed (6 wk onward) were found to be safe and efficacious. Expulsion rates were found to be highest in the immediate postpartum groups ranging from 14% to 27%. Immediate post placental insertion found to have expulsion rates that ranged from 3.6% to 16.2%. Expulsion rate was significantly higher after insertion following vaginal *vs* cesarean delivery. The rates of infection, perforation and unplanned pregnancy following postpartum IUD insertion are low. Method of insertion such as with ring forceps, by hand, or another placement method unique to the type of IUD did not show any significant difference in expulsion rates. Uterine perforations are highest in the delayed/interval IUD insertion groups. Breastfeeding duration and infant development are not affected by delayed/interval insertion of the non-hormonal (copper) IUD or the Levonorgestrel IUD. Timing of the Levonorgestrel IUD insertion may affect breastfeeding.

CONCLUSION: IUD insertion is safe and efficacious during the immediate postpartum, early postpartum and delayed postpartum periods. Expulsion rates are highest after vaginal delivery and when inserted during the immediate postpartum period. IUD associated infection rates were not increased by insertion during the postpartum period over interval insertion rates.

There is no evidence that breastfeeding is negatively affected by postpartum insertion of copper or hormone-secreting IUD. Although perforation rates were higher when inserted after lactation was initiated. Randomized controlled trials are needed to further elucidate the consequence of lactation on postpartum insertion. Despite the concerns regarding expulsion, perforation and breastfeeding, current evidence indicates that a favorable risk benefit ratio in support of postpartum IUD insertion. This may be particularly relevant for women for whom barriers exist in achieving desired pregnancy spacing.

Key words: Access to intrauterine devices; Contraception; Expulsion; Intrauterine device; Long acting reversible contraception; Postpartum contraception; Postpartum intrauterine device; Postpartum intrauterine device placement; Post-placental insertion

© **The Author(s) 2016.** Published by Baishideng Publishing Group Inc. All rights reserved.

Core tip: Intrauterine device (IUD) insertion is safe and efficacious during the immediate postpartum, early postpartum and delayed postpartum periods. Expulsion rates are highest after vaginal delivery and when inserted during the immediate postpartum period. IUD associated infection rates were not increased by insertion during the postpartum period over interval insertion rates. Despite the concerns regarding expulsion, perforation and breastfeeding, current evidence indicates that a favorable risk benefit ratio in support of postpartum IUD insertion.

Rezai S, Bisram P, Nezam H, Mercado R, Henderson CE. Postpartum intrauterine device contraception: A review. *World J Obstet Gynecol* 2016; 5(1): 134-139 Available from: URL: <http://www.wjgnet.com/2218-6220/full/v5/i1/134.htm> DOI: <http://dx.doi.org/10.5317/wjog.v5.i1.134>

INTRODUCTION

The intrauterine device (IUD), a form of long acting reversible contraception (LARC), is one of the most effective contraceptive methods available as well as one of the safest. Its effectiveness can largely be attributed to its low rate of unintended pregnancy that is likely due to its use being patient-independent^[1]. Its safety is supported by recent literature, which documents low rates of infection, perforation, and expulsion that should not deter a clinician from offering it as a contraception option. Furthermore, IUD insertion is not only a viable option for the nulliparous, but should also be considered as an option during the postpartum period^[1].

An inter-pregnancy interval of less than 24 mo has been shown to be associated with increased maternal/infant morbidity and mortality when compared to longer inter pregnancy intervals^[2,3]. Postpartum IUD insertion

is a useful way to achieve recommended pregnancy spacing. Safe and efficacious postpartum insertion of the IUD may occur up to 48 h after delivery of the placenta, and 4-6 wk postpartum^[4,5]. Although the immediate placement has been associated with a higher expulsion rate, the benefits of immediate insertion for preventing unplanned pregnancy in select populations may outweigh the risk of expulsion^[4,5].

Postpartum IUD insertion has no affect on breastfeeding. It is particularly important that recent studies have documented that even the levonorgestrel-releasing devices have no affect on breastfeeding^[6-9]. The levonorgestrel containing IUD has only a local effect on the endometrium with minimal transfer to the serum and even lower levels detected in the breast milk. Women can therefore be reassured that the use of an IUD during the postpartum period will not prevent them from providing their infant with breast milk that is of adequate quantity and quality.

Although IUD insertion in the postpartum period is highly favored by the current literature, many barriers of insertion still exist such as failure to return for postpartum follow up, lack of access to IUD^[10], lack of knowledge by provider, and inadvertent early pregnancy^[11]. Some of these barriers can be overcome with immediate postpartum insertion^[12] as women are more motivated to obtain contraception and counseling services are readily available at this time^[11,13].

The objective of this review is to evaluate the safety and efficacy of IUD insertion in the postpartum, with special attention to specific time frames for insertion that are associated with the best clinical outcomes. Additionally, data supporting the safety of IUDs in breastfeeding is used to further reinforce support for the insertion of IUDs in the postpartum period^[14].

MATERIALS AND METHODS

Selection criteria

Inclusion criteria: Randomized controlled trials and prospective cohort studies.

Participants: Postpartum women off with no contraindications to IUD insertion.

Intervention time: IUD insertions during any time during the postpartum period, Immediate post placenta period (within 10 min), early post placenta period (10 min to 72 h), and delayed/interval period (greater than 6 wk). Other comparators included vaginal or cesarean deliveries, manual or ring forceps placement and IUD type.

Types of outcomes: Expulsion, pregnancy, continuation, infection and perforation rates. Measurements of quantity and quality of milk production were assessed by breastfeeding duration and infant growth.

Exclusion criteria: Retrospective studies, no time of

postpartum insertion, no cases of immediate or delayed postpartum IUD insertion.

RESULTS

Fifteen studies were included. Ten evaluated the safety (infections, perforations) and efficacy (expulsion, pregnancy, continuation of use) of postpartum IUD insertion. Five studies evaluated the effect on breast-feeding of both non-secreting and hormone secreting IUDs.

Evaluation of safety and efficacy by comparing insertion at different time periods

The safety and efficacy of IUD insertion within 10 min of placenta delivery, early postpartum (10 min to 48 h) and interval/delayed insertion (4-6 wk postpartum) were supported by 4 studies. Expulsion rates were highest when the insertion occurred in the early and immediate postpartum periods. Low complication rates and no significant difference between groups was found for infection, uterine perforation, and unplanned pregnancy^[5,15-18].

Two of the four studies compared the three postpartum periods of insertion finding a statistically significant increase in expulsion rate during the immediate postpartum and early postpartum period when compared to interval insertion^[16,17]. Two randomized controlled trials compared only two time periods; immediate post-partum and interval period, finding^[15,18]. Vaginal deliveries were shown to have higher rates of expulsion across the included studies^[15-18].

Evaluation of safety and efficacy for immediate postpartum period insertion

Results of 6 prospective observational studies on IUD insertion only during the immediate postpartum period (within 10 min post placenta) have shown that immediate insertion is safe and efficacious whether after cesarean or vaginal birth^[2,13,19-21].

Immediate postpartum IUD insertion is a common practice in countries such as India and China. Two large multicenter studies, one with 300 women, and the other with 2733 women showed lower than expected expulsion rates than the rest of the studies included in this review. However, these studies conducted in India and China reported rates of complications such as infection, perforations and unplanned pregnancy similar to other studies that we reviewed^[2,22]. A more thorough study with multiple follow up evaluations and acknowledgement of those lost to follow-up showed expulsion rates that were more representative of the current literature^[21].

A possible explanation for the exceptionally lower expulsion rates in the two studies mentioned above is that Singal *et al*^[22] did not take into account patients who were lost to follow up. Kumar *et al*^[2] had a follow up period of only six weeks, which is not adequate

for evaluating safety and efficacy of postpartum IUD insertion. Despite this, these studies provide insight on the use of IUDs in countries where immediate postpartum insertion may be most valuable.

These two studies from India and China demonstrated that regardless of insertion method there is no significant difference in expulsion rates. Although method of insertion has not been shown to affect the safety and efficacy, complication rates are affected by method of delivery. Expulsion rates have been shown to be significantly higher after vaginal delivery vs cesarean section^[21].

Effect of the copper or levonorgestrel IUD on lactation

Further motivation for a woman to choose an IUD in the postpartum is the fact that both the copper IUD and Levonorgestrel operate locally on the endometrium. Therefore, there is no affection on lactation. Four studies, demonstrated the safety of IUD use during breast-feeding^[7,9,23,24].

Two randomized controlled trials compared hormone-secreting to copper IUD demonstrated no significant differences in breast-feeding performance (quantity, duration) and infant growth/development (quality) when inserted in the delayed/interval period to evaluate the effect of hormonal contraception on breast feeding success, a double-blind randomized controlled trial found that breast feeding continuation rates and infant growth were not affected by progestin only or combined oral contraception^[7,9].

The only study that examined the timing of IUD insertion and its effect on breastfeeding, while not reaching significance found that women in the delayed insertion group continued to breast feed at the 6 mo follow-up and had longer breastfeeding duration compared to the immediate post placental group^[15]. These findings certainly support further studies to determine what if any role timing of postpartum insertion has on breastfeeding.

DISCUSSION

Reports we reviewed found that IUD expulsion rates are higher in immediate and early postpartum insertion when compared to delayed insertion at the postpartum follow up visit. In general, reported IUD expulsion rates range from 2%-10%^[25]. In contrast, immediate postpartum expulsion can range from 4%-27% within one year of insertion^[5].

The reason for higher expulsion rates in immediate postplacental and early postpartum insertion is unclear but is most likely multifactorial. Incorrect insertion by health care providers due to inexperience and/or lack of skill in achieving high fundal placement may play a role^[2,3,14,22]. Another explanation for the increased expulsion rate may be due the type of delivery since insertion immediately after a vaginal delivery has been shown to have a higher expulsion rate than after

cesarean^[5,21,26]. One study went as far as recommending that immediate IUD insertion be contraindicated after vaginal delivery due to such high expulsion rates in comparison to cesarean: (after a vaginal birth, 50% (ultrasound only) + 27.8% (clinical examination); and post-cesarean section, 0% [$P < 0.001$; odds ratio (OR) = 5.75, 95%CI: 2.36-14.01]^[26]. Method of insertion, whether by hand or by forceps after a vaginal delivery, demonstrate similar expulsion rates, thus is unlikely to be a contributing factor^[20].

Despite higher expulsion rate, the immediate postpartum period provides an opportunity for patient counseling on the possibility of expulsion. Although rates of expulsion are higher in the immediate postpartum, the convenience of insertion after delivery of the placenta may outweigh the expulsion potential by increasing access to effective contraception. This may be especially relevant for select populations that may not return for follow up and be come at risk for an unplanned pregnancy.

Infection and perforations were examined to assess factors that affect the safety of postpartum IUD insertion. For the non-postpartum patient, perforations occur at a rate of about 1/1000 or less insertions^[27]. Where as in the postpartum, the studies used for this review demonstrated a range from no perforations to slightly increased rates over that for interval insertion. The most important determinant of uterine perforation based on these studies is the time of insertion. In one study, when compared to interval insertion, there was an increased perforation rate at 0-3 mo postpartum insertion (OR = 11.7, 95%CI: 2.8-49.2) and an even higher increase at 3-6 mo postpartum insertion (OR = 13.2, 95%CI: 2.8-62). However the rates did not increase in the immediate postpartum insertion or after 6 mo^[28]. Another study not included in the results section, showed that women had a 10 fold risk of uterine perforation if the IUD was inserted during lactation^[29]. With these results, it seems that the puerperium period poses an increased risk of uterine perforation with IUD insertion especially if the woman is lactating. It is possible that the associated hormonal and structural changes that take place during the puerperium period, such as thinning of endometrial wall, make the uterus more prone to perforation^[14]. The Mirena is especially implicated in perforations with insertion during lactation, likely due to the compounded effects from progestins and other hormonal changes during lactation that cause endometrial wall thinning^[6].

The infection rate (PID) with most of the studies used in this review either demonstrated no infection or very low rates that were not any different than the rates of non-postpartum women. All women in these studies were screened for STIs before insertion, and excluded if positive. These results agree with the current accepted rate of PID after IUD insertion of 0%-2% when no infection was present previously and 0%-5% when insertion occurs with an undetected infection^[30].

Furthermore, studies indicate that with prompt treatment with positive chlamydia cultures after IUD insertion are unlikely to develop PID even with retention of the IUD^[31]. The Mirena may even decrease the risk of PID due to the thickening of the cervical mucus and thinning of the endometrium^[32]. Overall, we found that that IUD insertion at anytime does not significantly increase the risk of PID.

Studies on the effect of IUDs on lactation generally show no detrimental effect on the duration, quantity, and quality of lactation^[6]. There may be a theoretical negative effect of progestins on breastfeeding, (which is why it is rated Category 2 by United States Medical Eligibility Criteria for Contraception) but more trials need to be completed to evaluate this proposed lactation risk. Also, an evaluation of the timing of levonorgestrel-IUD insertion and lactation indicated that women who received immediate postpartum insertion had a shorter duration of breastfeeding and were less exclusive with breastfeeding than women who received delayed insertion^[23]. The author's suggests that because withdrawal from progesterone helps to initiate lactation, the progestins (from the IUD) placed in the immediate postpartum period, may act to inhibit lactogenesis. However, progestin-only contraception is recommended by the United States Medical Eligibility Criteria for Contraceptive (Category 2) with or without breastfeeding in the immediate postpartum.

Postpartum (including while breastfeeding) insertion of IUD is recommended by ACOG as a safety and effective method of contraception. It is safe and effective to insert an IUD (copper or levonorgestrel-releasing) in the immediate postpartum period (within 10 min of placental delivery)^[33,34] despite higher expulsion rates since the benefits may outweigh the risks in select populations. Insertion of the copper or levonorgestrel IUD 10 min to 4 wk and at or after 4 wk has also shown to be safe and effective. Overall, LARC methods have very few contraindications and most women are eligible for its use during the postpartum period^[35].

IUD insertion is efficacious and safe during the immediate postpartum, early postpartum and delayed postpartum periods^[36]. Expulsion rates are highest in when inserted during the immediate postpartum period after vaginal deliveries. In addition, infection and perforation rates following postpartum IUD insertion are low. Delayed insertion of the copper and levonorgestrel IUDs was found to have no affect breastfeeding initiation. However, immediate postpartum insertion was associated with a decrease breastfeeding duration and exclusivity. Adequately powered randomized controlled trials are needed to further elucidate the effect of timing of postpartum IUD insertion has on lactation^[37]. In spite of expulsion, perforations and breastfeeding duration concerns, IUD insertion in the postpartum should remain a viable family planning option for many women^[24]. This may be particularly important for select populations where the benefits may outweigh the risk

of failing to achieve desired pregnancy spacing.

ACKNOWLEDGMENTS

The authors would like to thank Ms. Judith Wilkinson, Medical Librarian at Lincoln Medical and Mental Health Center Science Library, for providing the reference articles.

COMMENTS

Background

The intrauterine device (IUD), a form of long acting reversible contraception (LARC), is one of the most effective contraceptive methods available as well as one of the safest. Its safety is supported by recent literature, which documents low rates of infection, perforation, and expulsion that should not deter a clinician from offering it as a contraception option.

Research frontiers

Despite the concerns regarding expulsion, perforation and breastfeeding, current evidence indicates that a favorable risk benefit ratio in support of postpartum IUD insertion. This may be particularly relevant for women for whom barriers exist in achieving desired pregnancy spacing.

Innovations and breakthroughs

IUD insertion is not only a viable option for the nulliparous, but should also be considered as an option during the postpartum period.

Applications

Despite the concerns regarding expulsion, perforation and breastfeeding, current evidence indicates that a favorable risk benefit ratio in support of postpartum IUD insertion. This may be particularly relevant for women for whom barriers exist in achieving desired pregnancy spacing.

Terminology

LARC: Methods include the IUD and the birth control implant. Both methods are highly effective in preventing pregnancy, last for several years, and are easy to use; Postpartum: A postpartum period or postnatal period is the period beginning immediately after the birth of a child and extending for about 6 wk. Less frequently used are the terms puerperium or puerperal period.

Peer-review

This is a good article.

REFERENCES

- American College of Obstetricians and Gynecologists. ACOG Practice Bulletin No. 121: Long-acting reversible contraception: Implants and intrauterine devices. *Obstet Gynecol* 2011; **118**: 184-196 [PMID: 21691183 DOI: 10.1097/AOG.0b013e318227f05e]
- Kumar S, Sethi R, Balasubramaniam S, Charurat E, Lalchandani K, Semba R, Sood B. Women's experience with postpartum intrauterine contraceptive device use in India. *Reprod Health* 2014; **11**: 32 [PMID: 24755312 DOI: 10.1186/1742-4755-11-32]
- Shukla M, Qureshi S. Post-placental intrauterine device insertion--a five year experience at a tertiary care centre in north India. *Indian J Med Res* 2012; **136**: 432-435 [PMID: 23041736]
- Grimes DA, Lopez LM, Schulz KF, Van Vliet HA, Stanwood NL. Immediate post-partum insertion of intrauterine devices. *Cochrane Database Syst Rev* 2010; (5): CD003036 [PMID: 20464722 DOI: 10.1002/14651858.CD003036.pub2]
- Sonalkar S, Kapp N. Intrauterine device insertion in the postpartum period: a systematic review. *Eur J Contracept Reprod Health Care* 2015; **20**: 4-18 [PMID: 25397890 DOI: 10.3109/13625187.2014.971454]
- Goldstuck ND, Steyn PS. Intrauterine contraception after cesarean section and during lactation: a systematic review. *Int J Womens Health* 2013; **5**: 811-818 [PMID: 24348074 DOI: 10.2147/IJWH.S53845]
- Heikkilä M, Luukkainen T. Duration of breast-feeding and development of children after insertion of a levonorgestrel-releasing intrauterine contraceptive device. *Contraception* 1982; **25**: 279-292 [PMID: 6804164]
- Rodrigues da Cunha AC, Dorea JG, Cantuaria AA. Intrauterine device and maternal copper metabolism during lactation. *Contraception* 2001; **63**: 37-39 [PMID: 11257247]
- Shaamash AH, Sayed GH, Hussien MM, Shaaban MM. A comparative study of the levonorgestrel-releasing intrauterine system Mirena versus the Copper T380A intrauterine device during lactation: breast-feeding performance, infant growth and infant development. *Contraception* 2005; **72**: 346-351 [PMID: 16246660]
- Goodman SR, Benedict C, Reeves MF, Pera-Floyd M, Dela Cruz M, Foster-Rosales A. Minimizing Barriers to IUD use: the impact of post-abortion IUD, simplified screening criteria and staff re-introduction. *Contraception* 2006; **74**: 180 [DOI: 10.1016/j.contraception.2006.05.009]
- Ogburn JA, Espey E, Stonehocker J. Barriers to intrauterine device insertion in postpartum women. *Contraception* 2005; **72**: 426-429 [PMID: 16307964]
- Van Der Pas MT, Delbeke L, Van Dets H. Comparative performance of two copper-wired IUDs (ML Cu 250 and T Cu 200: immediate postpartum and interval insertion. *Contracept Deliv Syst* 1980; **1**: 27-35 [PMID: 12261715]
- Celen S, Möröy P, Sucak A, Aktulay A, Danişman N. Clinical outcomes of early postplacental insertion of intrauterine contraceptive devices. *Contraception* 2004; **69**: 279-282 [PMID: 15033401]
- Farr G, Rivera R. Interactions between intrauterine contraceptive device use and breast-feeding status at time of intrauterine contraceptive device insertion: analysis of TCu-380A acceptors in developing countries. *Am J Obstet Gynecol* 1992; **167**: 144-151 [PMID: 1442918]
- Chen BA, Reeves MF, Hayes JL, Hohmann HL, Perriera LK, Creinin MD. Postplacental or delayed insertion of the levonorgestrel intrauterine device after vaginal delivery: a randomized controlled trial. *Obstet Gynecol* 2010; **116**: 1079-1087 [PMID: 20966692 DOI: 10.1097/AOG.0b013e3181f73fac]
- Dahlke JD, Terpstra ER, Ramseyer AM, Busch JM, Rieg T, Magann EF. Postpartum insertion of levonorgestrel--intrauterine system at three time periods: a prospective randomized pilot study. *Contraception* 2011; **84**: 244-248 [PMID: 21843688 DOI: 10.1016/j.contraception.2011.01.007]
- Eroglu K, Akkuzu G, Vural G, Dilbaz B, Akin A, Taşkin L, Haberal A. Comparison of efficacy and complications of IUD insertion in immediate postplacental/early postpartum period with interval period: 1 year follow-up. *Contraception* 2006; **74**: 376-381 [PMID: 17046378]
- Whitaker AK, Endres LK, Mistretta SQ, Gilliam ML. Postplacental insertion of the levonorgestrel intrauterine device after cesarean delivery vs. delayed insertion: a randomized controlled trial. *Contraception* 2014; **89**: 534-539 [PMID: 24457061 DOI: 10.1016/j.contraception.2013.12.007]
- Tatum HJ, Beltran RS, Ramos R, Van Kets H, Siviv I, Schmidt FH. Immediate postplacental insertion of GYNE-T 380 and GYNE-T 380 postpartum intrauterine contraceptive devices: randomized study. *Am J Obstet Gynecol* 1996; **175**: 1231-1235 [PMID: 8942493]
- Xu JX, Rivera R, Dunson TR, Zhuang LQ, Yang XL, Ma GT, Chi IC. A comparative study of two techniques used in immediate postplacental insertion (IPPI) of the Copper T-380A IUD in Shanghai, People's Republic of China. *Contraception* 1996; **54**: 33-38 [PMID: 8804806]
- Zhou SW, Chi IC. Immediate postpartum IUD insertions in a Chinese hospital--a two year follow-up. *Int J Gynaecol Obstet* 1991; **35**: 157-164 [PMID: 1680090]

- 22 **Singal S**, Bharti R, Dewan R, Divya A, Batra A, Sharma M, Mittal P. Clinical Outcome of Postplacental Copper T 380A Insertion in Women Delivering by Caesarean Section. *J Clin Diagn Res* 2014; **8**: OC01-OC04 [PMID: 25386484 DOI: 10.7860/JCDR/2014/10274.4786]
- 23 **Chen BA**, Reeves MF, Creinin MD, Schwarz EB. Postplacental or delayed levonorgestrel intrauterine device insertion and breast-feeding duration. *Contraception* 2011; **84**: 499-504 [PMID: 22018124 DOI: 10.1016/j.contraception.2011.01.022]
- 24 **Espey E**, Ogburn T, Leeman L, Singh R, Ostrom K, Schrader R. Effect of progestin compared with combined oral contraceptive pills on lactation: a randomized controlled trial. *Obstet Gynecol* 2012; **119**: 5-13 [PMID: 22143258 DOI: 10.1097/AOG.0b013e31823dc015]
- 25 **Hatcher RA**, Trussell J, Nelson AL, Cates W, Stewart FH, Kowal D editor. Contraceptive technology: nineteenth revised edition. New York, NY: Ardent Media, 2007: (Clinical Practice Tools: Contraceptive Efficacy Tools: 19-47) and (Contraceptive efficacy: 747-826)
- 26 **Letti Müller AL**, Lopes Ramos JG, Martins-Costa SH, Palma Dias RS, Valério EG, Hammes LS, Glitz CL, Zucatto AE, Vettori DV, Magalhães JA. Transvaginal ultrasonographic assessment of the expulsion rate of intrauterine devices inserted in the immediate postpartum period: a pilot study. *Contraception* 2005; **72**: 192-195 [PMID: 16102554]
- 27 Mechanism of action, safety and efficacy of intrauterine devices. Report of a WHO Scientific Group. *World Health Organ Tech Rep Ser* 1987; **753**: 1-91 [PMID: 3118580]
- 28 **Caliskan E**, Oztürk N, Dilbaz BO, Dilbaz S. Analysis of risk factors associated with uterine perforation by intrauterine devices. *Eur J Contracept Reprod Health Care* 2003; **8**: 150-155 [PMID: 14667326]
- 29 **Heartwell SF**, Schlesselman S. Risk of uterine perforation among users of intrauterine devices. *Obstet Gynecol* 1983; **61**: 31-36 [PMID: 6823347]
- 30 **Committee on Adolescent Health Care Long-Acting Reversible Contraception Working Group**, The American College of Obstetricians and Gynecologists. Committee opinion no. 539: adolescents and long-acting reversible contraception: implants and intrauterine devices. *Obstet Gynecol* 2012; **120**: 983-988 [PMID: 22996129]
- 31 **Grimes DA**. Intrauterine device and upper-genital-tract infection. *Lancet* 2000; **356**: 1013-1019 [PMID: 11041414]
- 32 **Toivonen J**, Luukkainen T, Allonen H. Protective effect of intrauterine release of levonorgestrel on pelvic infection: three years' comparative experience of levonorgestrel- and copper-releasing intrauterine devices. *Obstet Gynecol* 1991; **77**: 261-264 [PMID: 1899136]
- 33 **O'Hanley K**, Huber DH. Postpartum IUDs: keys for success. *Contraception* 1992; **45**: 351-361 [PMID: 1516367]
- 34 **Xu JX**, Reusché C, Burdan A. Immediate postplacental insertion of the intrauterine device: a review of Chinese and the world's experiences. *Adv Contracept* 1994; **10**: 71-82 [PMID: 8030457]
- 35 **American College of Obstetricians and Gynecologists Committee on Gynecologic Practice**; Long-Acting Reversible Contraception Working Group. ACOG Committee Opinion no. 450: Increasing use of contraceptive implants and intrauterine devices to reduce unintended pregnancy. *Obstet Gynecol* 2009; **114**: 1434-1438 [PMID: 20134301 DOI: 10.1097/AOG.0b013e3181c6f965]
- 36 **Brown T**. Contraceptive Placement at Delivery Trumps Delayed Placement, WebMD LLC [Accessed 2015 Jun 17]. Available from: URL: <http://www.medscape.com/viewarticle/846328>
- 37 **Shikary ZK**, Betrabet SS, Patel ZM, Patel S, Joshi JV, Toddywala VS, Toddywala SP, Patel DM, Jhaveri K, Saxena BN. ICMR task force study on hormonal contraception. Transfer of levonorgestrel (LNG) administered through different drug delivery systems from the maternal circulation into the newborn infant's circulation via breast milk. *Contraception* 1987; **35**: 477-486 [PMID: 3113823]

P- Reviewer: Khajehei M **S- Editor:** Ji FF **L- Editor:** A
E- Editor: Wu HL

