



Use of ultrasound in predicting success of intrauterine contraceptive device insertion immediately after delivery

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KEYWORDS: Copper T; IUD; postplacental delivery; prediction of success; ultrasound

ABSTRACT

Objectives To assess by ultrasound examination the success of insertion of an intrauterine contraceptive device (IUD) immediately after delivery and to determine the optimal distance between the lower end of the IUD and the internal os in predicting successful retention of an IUD.

Methods This was a prospective study carried out between December 2012 and April 2013. Two ultrasound examinations, transabdominal and transvaginal, were performed prior to hospital discharge following delivery and again at 6 weeks following delivery in women who received a postpartum IUD. Distance from the internal os to the lower end of the IUD was measured at each examination and compared in unsuccessful and successful cases of postvaginal delivery (PVD) and post-Cesarean section (PCS) IUD insertion. Logistic regression and receiver–operating characteristics (ROC) curve analysis were used to determine the difference in success between the two modes of delivery and to determine the optimal cut-off of the internal os-to-IUD distance for successful retention, respectively.

Results Ninety-one women were included in the study, comprising 60 PVD and 31 PCS IUD insertions. Thirteen PVD (22.4%) and eight PCS (25.8%) IUDs were either expelled spontaneously or removed at the 6-week scan because of improper placement. Mean distance from the internal os to the lower end of the IUD on ultrasound examination immediately after insertion was significantly greater in successful cases than in those in which IUDs were subsequently expelled/displaced (mean difference after PVD insertion, 20.1 mm ($P = 0.006$); mean difference after PCS insertion, 10.3 mm ($P = 0.05$)). Logistic regression analysis demonstrated that mode of

delivery was not independently associated with successful retention of the IUD ($P = 0.72$; OR, 0.831 (95% CI, 0.301–2.189)). The distance from the lower end of the IUD to the internal os measured at ultrasound examination prior to hospital discharge provided reasonable predictive accuracy for determining retention of the IUD, with an area under the ROC curve of 0.74 (95% CI, 0.60–0.88) and an optimal cut-off of ≥ 30 mm (sensitivity, 64.71% (95% CI, 52.17–75.92%) and specificity, 80.95% (95% CI, 58.09–94.55%)).

Conclusions IUD insertion immediately postpartum is feasible but carries a substantial risk of unsuccessful IUD retention. Ultrasound examination after insertion of an IUD could be considered for predicting the success of IUD retention. Copyright © 2014 ISUOG. Published by John Wiley & Sons Ltd.

INTRODUCTION

Use of contraception is one of the global reproductive health indicators that determine the total fertility rate¹. Contraceptive prevalence in most developed countries is greater than 70% and is lowest in sub-Saharan regions (25%)². High contraceptive prevalence is essential in countries in which termination of pregnancy is illegal, as unintended pregnancy could lead to criminal abortion and its consequences.

In 2007, there were an estimated total of 162 680 000 women using intrauterine contraceptive devices (IUDs) worldwide³. This represented 23% of all contraceptive users and 14% of all women aged 15–49 years³. Insertion of an IUD immediately after delivery (within 10 min of placental delivery) has been described recently in the context of optimizing the use of reliable, effective and long-lasting contraceptive methods. Immediate postpartum IUD inser-

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tion is promising in many ways as women are highly motivated to use contraception and the setting at the time of delivery is convenient for both the woman and the provider⁴. Available literature shows that the expulsion rate of IUDs varies between 7% and 15%, indicating a higher rate of unsuccessful retention when an IUD is inserted at the time of delivery compared to insertion 6 weeks after delivery⁵. Most of these studies used visualization of the IUD thread after 6 weeks as the outcome measure of success. Displacement of an IUD within the uterus (dislodgement into the cervical canal) cannot be assessed clinically; however, such displacement reduces the optimum contraceptive efficacy of an IUD⁶. Anteby *et al.* reported a 14-times higher incidence of pregnancy in women with an intracervical IUD than in women with an IUD positioned in the uterine fundus (OR, 13.93 (95% CI, 4.13–48.96))⁷. The authors suggested that cases of failed contraceptive action of the IUD may be secondary to a malpositioned device and recommended an ultrasound examination to identify displaced devices⁷. Predicting the rate of IUD retention is important because it can enable determination of the risk of, and thus avoidance of, an unplanned pregnancy.

The aims of this study were to assess whether ultrasound can be used to predict the success of postvaginal delivery (PVD) and post-Cesarean section (PCS) IUD insertion and to determine the optimal distance between the lower end of the IUD and the internal os in the prediction of successful IUD insertion.

METHODS

This was a prospective observational study carried out at District General Hospital Ampara, Sri Lanka, between December 2012 and April 2013. Women who delivered in the hospital without contraindications for IUD insertion were included in the study after informed consent was obtained during the antenatal period⁸. Contraindications for IUD insertion according to hospital protocol were: anemia (hemoglobin < 10 g/dL), postpartum hemorrhage, prolonged prelabor rupture of membranes and obstructed labor. Formal training for the IUD insertion technique, with hands-on experience, was given to all resident doctors of the labor ward.

Women with PVD IUD insertion remained in the dorsal position after vaginal delivery and underwent immediate insertion of the IUD (TCu 380A; Obelis SA, Brussels, Belgium) after delivery of the placenta. The IUD was introduced into the uterine cavity with guidance from the index and middle fingers. In order to facilitate smooth insertion, suprapubic pressure was applied to move the uterus into a more axial plane and minimize retroversion. The IUD was then placed in the highest possible position in the uterine cavity.

In women with PCS IUD insertion, the IUD (TCu 380A) was placed at the fundus of the uterus, through the incision made during Cesarean section, as soon as the placenta and membranes were delivered. Routine closure of the uterine incision was performed subsequently.

All patients were told to check the position of their IUD if they experienced any bleeding. Two ultrasound examinations were performed: first, before discharge from the hospital and second, 6 weeks following delivery. On each occasion both transabdominal and transvaginal ultrasound examinations were performed. A single experienced operator (C.G.) measured the distance from each wall of the uterus to the body of the IUD and from the lower edge of the IUD to the internal cervical os in both examinations. In cases of uncertainty regarding ultrasound measurements, an opinion from the principal investigator (T.D.) was sought.

The IUD was defined as being 'in place' when visualized in close proximity to the uterine fundus and when both distances, one from each uterine wall to the body of the IUD, were similar (Figure 1). The choice of using the distance between the lower pole of the IUD and the internal cervical os to predict successful IUD insertion was based on the assumption that when the device is displaced from its normal position the distance between its lower end and the cervix should be reduced; on the other hand, this distance should remain relatively constant when the IUD remains in its normal position, close to the uterine fundus. Presence of the IUD thread was documented in each examination. At the review at 6 weeks postpartum, mothers were asked about history of fever, abnormal vaginal discharge or expulsion of the IUD. In the absence of history of expulsion of the IUD and if it was not visualized by ultrasound, an X-ray of the pelvis was offered to exclude intra-abdominal dislodgement of the IUD. Since the IUD should be placed completely inside the uterus in order to achieve optimum efficacy⁷, complete expulsion and displacement of the IUD into the uterine cervix was considered as unsuccessful IUD retention. The study protocol was approved by the ethics review committee of the hospital.

Statistical analysis

Mean distance from the lower end of the IUD to the internal os at the first ultrasound examination prior to hospital discharge (in both immediate PVD and PCS insertions) was compared in successful and unsuccessful IUD retention groups at the 6-week scan. The Mann–Whitney *U*-test was used to compare continuous non-normally distributed data. All *P*-values are reported as two-tailed and *P* < 0.05 was considered statistically significant. Logistic regression analysis was performed to determine the difference in success between PVD and PCS IUD insertions. Receiver–operating characteristics (ROC) curve analysis was used to determine the accuracy of the distance (mm) from the lower end of the IUD to the internal os, measured at the scan prior to discharge, in predicting IUD retention or expulsion. Summary estimates of sensitivity, specificity, positive (PPV) and negative (NPV) predictive values, positive (+LR) and negative (–LR) likelihood ratios and diagnostic odds ratios (OR) were then calculated to define the optimal cut-off value (distance) for successful IUD

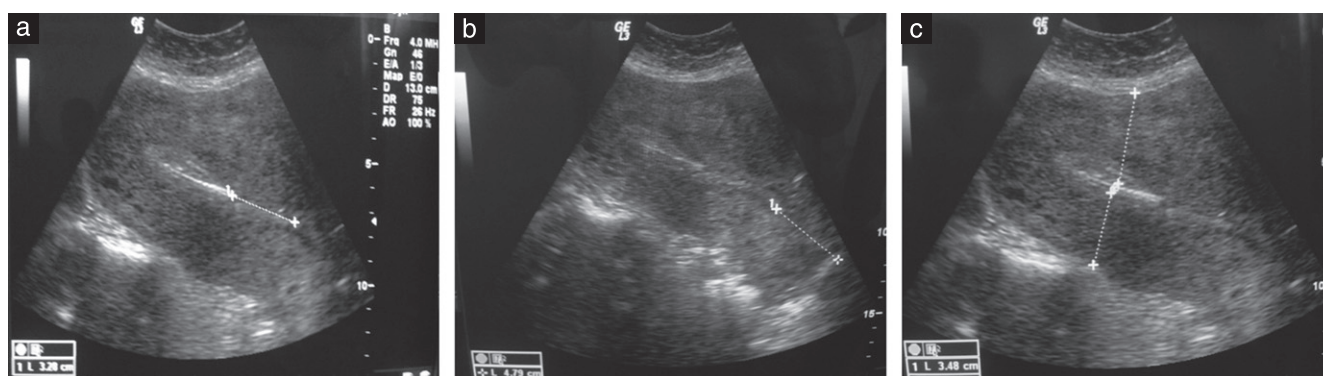


Figure 1 Transabdominal ultrasound images in a woman with an intrauterine contraceptive device (IUD) inserted immediately after vaginal birth, showing: (a) distance from lower end of IUD to internal os, (b) cervical length and (c) distances from IUD to anterior and posterior walls of uterus.

insertion. A *post-hoc* analysis was performed to assess the required sample size for comparison of the area under the ROC curve with a null hypothesis value. STROBE and STARD guidelines were followed. Statistical analysis was performed using StatsDirect (StatsDirect statistical software, StatsDirect Ltd. 2013, Cheshire, England; <http://www.statsdirect.com>) and MedCalc for Windows, version 12.5 (MedCalc Software, Ostend, Belgium).

RESULTS

Ninety-four women who had an IUD inserted immediately after delivery were included in the study. Among these, three were lost to follow-up, providing a total of 91 women with immediate postdelivery (60 PVD and 31 PCS) IUD insertion available for analysis. Basic characteristics of the study population are given in Table 1. There were no reported cases of pelvic inflammatory disease (PID) or perforation in the study group. Two PVD IUDs were expelled before hospital discharge. Thirteen PVD (22.4%) and eight PCS (25.8%) IUDs were either subsequently expelled spontaneously or removed at the 6-week scan because of displacement (Figure 2). The IUD thread was present in all 17 unsuccessful cases in which IUDs were removed because of displacement. A summary of ultrasound measurements at each examination is given in Table 2. Mean distance from the internal os to the lower end of the IUD, measured at the ultrasound scan prior to hospital discharge, was almost twice the length in successful cases as compared to unsuccessful cases, for both PVD and PCS IUD insertions; the mean difference between the distance in successful *vs* unsuccessful cases was 20.1 mm ($P=0.006$) and 10.3 mm ($P=0.05$) in PVD and PCS insertions, respectively. Logistic regression analysis demonstrated that mode of delivery was not independently associated with successful retention of the IUD ($P=0.7197$; OR, 0.831 (95% CI, 0.301–2.189)); therefore, a common cut-off value was considered for both PVD and PCS groups.

Table 1 Characteristics of women receiving an intrauterine contraceptive device immediately after delivery, according to mode of delivery

Characteristic	Vaginal delivery (n = 60)	Cesarean section (n = 31)
Age (years)	26.4 ± 5.6	29.7 ± 5.9
GA at delivery (weeks)	38.6 ± 1.0	38.4 ± 1.0
BMI (kg/m ²)	23.9 ± 4.4	23.9 ± 4.4
Parity		
Primiparous	25	11
Multiparous	35	20

Data are given as mean ± SD or *n*. BMI, body mass index; GA, gestational age.

The distance from the lower end of the IUD to the internal os at the discharge scan was moderately accurate in predicting retention of the IUD, with an area under the curve (AUC) of 0.74 (95% CI, 0.60–0.88) and an optimal cut-off of ≥ 30 mm (sensitivity, 64.71% (95% CI, 52.17–75.92%); specificity, 80.95% (95% CI, 58.09–94.55%); PPV, 91.67% (95% CI, 80.02–97.68%); NPV, 41.46% (95% CI, 26.32–57.89%); +LR, 3.40 (95% CI, 1.57–8.56); -LR, 0.44 (95% CI, 0.30–0.66; OR, 7.79 (95% CI, 2.15–34.64)) (Figure 3). Accuracy of different thresholds of distance between the lower end of the IUD and the internal cervical os in predicting successful IUD retention is reported in Table S1. A *post-hoc* power analysis with an alpha of 0.05 and a beta of 0.80 demonstrated that at least 21 women per group were required.

DISCUSSION

This study showed that, in women in whom an IUD was placed immediately following delivery, the IUD was either expelled spontaneously or removed because of displacement in 25% of cases and mode of delivery did not influence the IUD success rate. Ultrasound could be used to predict the success of IUD insertion immediately after delivery and a distance ≥ 30 mm between the lower edge of the IUD and the internal cervical os provided the

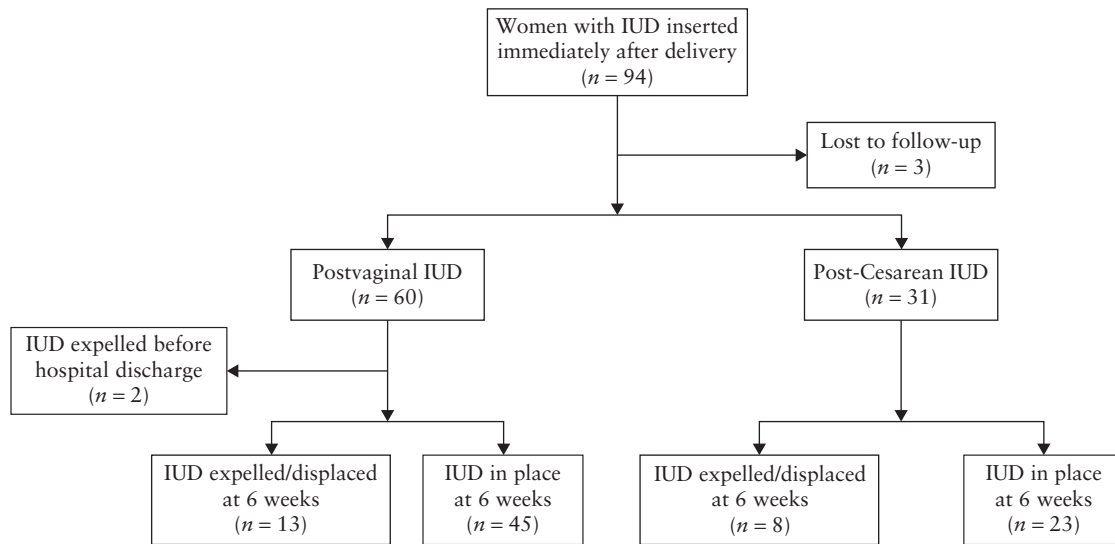


Figure 2 Flowchart of study population of 94 women who received an intrauterine contraceptive device (IUD) immediately after vaginal delivery or Cesarean section.

Table 2 Ultrasound findings prior to hospital discharge and at 6 weeks following delivery in women receiving an intrauterine contraceptive device (IUD) immediately postvaginal delivery (PVD) or post-Cesarean section (PCS)

Ultrasound finding	PVD (n = 60)		PCS (n = 31)	
	Immediately postpartum	6 weeks postpartum	Immediately postpartum	6 weeks postpartum
IUD in place	58	45	31	23
IUD expelled	2	3	0	1
IUD displaced	0	10	0	7
Distance from internal os to lower part of IUD (mm)	38.3 ± 23.4	16.7 ± 13.5	22.1 ± 24.8	15.5 ± 14.8
IUD thread present	58/60	55/58	13/31	12/31

Data are given as *n*, mean ± SD or *n/N*.

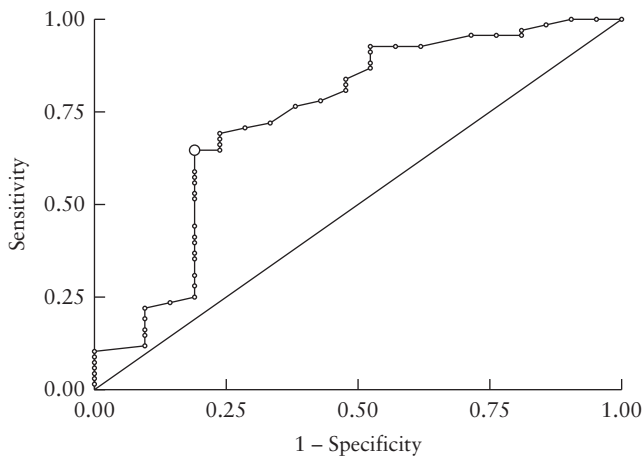


Figure 3 Receiver–operating characteristics curve analysis of distance from internal os to lower edge of intrauterine contraceptive device (IUD) for prediction of successful retention in women receiving postvaginal or post-Cesarean IUD.

best combination of sensitivity and specificity in predicting successful IUD placement 6 weeks after insertion.

Postpartum contraception is commenced routinely after puerperium but women are at risk of unintended pregnancies during the puerperial period as most women

are sexually active by this time and ovulation can occur⁹. Unintended pregnancies in the first year after delivery occur with a rate as high as 10–44%^{10,11} and can lead to induced abortion and its consequences, which are of particular concern in countries in which termination of pregnancy is illegal. Therefore, immediate postpartum IUD insertion is beneficial for women who desire early contraception and for women who have difficulty in returning for postpartum visits for contraception.

This study demonstrated that the rate of unsuccessful retention of an IUD inserted just after delivery is as high as 23–26%. In the context of a high rate of unsuccessful retention in immediate postpartum IUD insertion, use of ultrasound in predicting success is invaluable. We found that ultrasound could be used effectively to predict the success of IUD insertion after vaginal and Cesarean delivery. If the length between the lower end of the IUD and the internal os is ≥ 3 cm, a significant number of IUDs would remain in place up to 6 weeks postpartum. This is the first study to examine the option of ultrasound in predicting the success of immediate postpartum IUD insertion. The main limitation of this study was that patients were followed with ultrasound scans performed by a single operator, and only one measurement of the distance between the lower end of the IUD and the internal

cervical os was recorded, thus precluding assessment of inter- and intraobserver variability and the overall reproducibility of this method. Furthermore, although the study was sufficiently powered, the relatively small number of women included did not allow subanalyses according to parity, labor characteristics and type of unsuccessful IUD retention (expulsion or displacement). However, we did not find any independent influence of the mode of delivery on retention success rate of the IUD.

It is recognized that the entire IUD should be in place inside the uterine cavity to achieve optimum contraceptive efficacy⁸. Previously published studies have quoted unsuccessful IUD retention rates lower than ours^{4,12}. Nevertheless, most of these studies considered only presence of the IUD thread as a successful insertion. We found that the IUD thread was present in most failed cases but the IUD was displaced, a finding diagnosed by ultrasound. Therefore, presence of the IUD thread alone is not adequate to reassure patients after insertion. A recent study by Jatlaoui *et al.* reported a high rate of unsuccessful IUD retention: 19.3% (17/88), in which 41.2% (7/17) were partial expulsions (displaced) and the IUD thread was present at the time of second examination after PVD IUD insertion¹³.

Experience of the health professional has been recognized as a determinant of success in IUD insertion^{14,15}. However, Jatlaoui *et al.* did not find a significant difference in the risk of expulsion among IUDs placed by lower-level residents compared to those placed by senior-level residents¹³. Since the timing of spontaneous delivery is not predictable, every resident working in the delivery suite should be competent in inserting an IUD.

Risk of infection is one of the main concerns in postpartum IUD insertion. The incidence of PID does not appear to be increased in women receiving an IUD immediately postpartum compared to those with interval insertion or to controls who did not receive an IUD¹². Additionally, we did not find any case of pelvic infection after IUD insertion in our study.

In conclusion, immediate postpartum IUD insertion is feasible but carries a substantial risk of unsuccessful retention. Ultrasound examination after IUD insertion

could be used effectively to predict the success of IUD retention. Visibility of the IUD thread at 6 weeks alone is not sufficient to reassure women regarding proper IUD placement since the IUD could still be displaced into the cervix despite the presence of the IUD thread. Large prospective studies are required to assess whether ultrasound may be a feasible tool providing reproducible results for counseling women regarding the success of an IUD insertion.

REFERENCES

1. United Nations, Department of Economic and Social Affairs, Population Division (2011). World Contraceptive Use 2010 (POP/DB/CP/Rev2010).
2. Family Health Bureau Ministry of Healthcare Nutrition Sri Lanka Colombo. Annual report on family health 2006–2007. Sri Lanka: Family Health Bureau, Ministry of Healthcare Nutrition, Colombo, Sri Lanka; 2009.
3. World Health Organization. Working document QAS/06.179. Stability testing of active substances and pharmaceutical products.
4. Shukla M, Qureshi S, Chandrawati. 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.
5. Kapp N, Curtis KM. Intrauterine device insertion during the postpartum period: a systematic review. *Contraception* 2009; 80: 327–336.
6. 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.
7. Anteby E, Revel A, Ben-Chetrit A, Rosen B, Tadmor O, Yagel S. Intrauterine device failure: relation to its location within the uterine cavity. *Obstet Gynecol* 1993; 81: 112–114.
8. Johnson BA. Insertion and removal of intrauterine devices. *Am Fam Physician* 2005; 71: 95–102.
9. Speroff L, Mishell DR Jr. The postpartum visit: it's time for a change in order to optimally initiate contraception. *Contraception* 2008; 78: 90–98.
10. Templeman CL, Cook V, Goldsmith LJ, Powell J, Hertweck SP. Postpartum contraceptive use among adolescent mothers. *Obstet Gynecol* 2000; 95: 770–776.
11. Kershaw TS, Niccolai LM, Ickovics JR, Lewis JB, Meade CS, Ethier KA. Short and long-term impact of adolescent pregnancy on postpartum contraceptive use: implications for prevention of repeat pregnancy. *J Adolesc Health* 2003; 33: 359–368.
12. Grimes DA, Lopez LM, Schulz KF, Van Vliet HA, Stanwood NL. Immediate post-partum insertion of intrauterine devices. *Cochrane Database Syst Rev* 2010 May 12;(5):CD003036. doi: 10.1002/14651858.CD003036.pub2.
13. Jatlaoui TC, Marcus M, Jamieson DJ, Goedken P, Cwiak C. Postplacental intrauterine device insertion at a teaching hospital. *Contraception* 2014; 89: 528–533.
14. Eroglu K, Akkuzu G, Vural G, Dilbaz B, Akin A, Taskin 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.
15. Celen S, Moroy P, Sucak A, Aktulay A, Danisman N. Clinical outcomes of early postplacental insertion of intrauterine contraceptive devices. *Contraception* 2004; 69: 279–282.

SUPPORTING INFORMATION ON THE INTERNET

The following supporting information may be found in the online version of this article:



Table S1 Diagnostic accuracy of different thresholds of distance between the lower end of the intrauterine contraceptive device (IUD) and the internal cervical os in predicting the retention of an IUD placed immediately after delivery (95% confidence intervals between parentheses)