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Relationship between the Development of Secondary Infertility in Women of Reproductive Age with Copper vs Hormonal Intrauterine Devices

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ABSTRACT: Background: The relationship between previous IUD use and secondary infertility remains controversial, particularly in developing countries where reproductive tract infections and contraceptive practices vary.

Aim: To investigate the association between previous use of Cu-IUDs and LNG-IUDs and secondary infertility among reproductive-age women.

Patients and Methods: This hospital-based case-control study was conducted at the Department of Obstetrics and Gynecology, Tikrit Teaching Hospital, Iraq, between October 2025 and June 2026. A total of 120 women aged 20–45 years were enrolled and allocated into three equal groups: women with secondary infertility following previous Cu-IUD use (n=40), women with secondary infertility following previous LNG-IUD use (n=40), and fertile women with previous IUD use serving as controls (n=40).

Results: The duration of marriage was significantly longer among women with secondary infertility than controls ($P=0.021$). Previous miscarriage was more frequent in infertile women ($P=0.046$), while parity was significantly lower ($P=0.018$). Women with previous Cu-IUD use had a longer duration of IUD use than LNG-IUD users (4.8 ± 2.1 vs. 3.6 ± 1.8 years, $P=0.011$). Imaging demonstrated significantly higher rates of tubal abnormalities among previous Cu-IUD users than LNG-IUD users ($P=0.041$), although IUD type was not independently associated with secondary infertility after adjustment for confounders.

Conclusion: Previous use of modern Cu-IUDs or LNG-IUDs was not independently associated with secondary infertility. Instead, prolonged IUD use, previous pelvic inflammatory disease, and delayed attempts to conceive after IUD removal were the principal factors associated with secondary infertility.

Introduction

Secondary infertility—defined as the failure to conceive after a previous pregnancy despite ≥ 12 months of regular unprotected intercourse—remains a key public-health concern with multifactorial etiologies spanning tubal disease, ovulatory dysfunction, endometrial factors, and male causes^(1–2). Globally, the increasing uptake of effective contraception, particularly long-acting reversible contraception (LARC) such as intrauterine devices (IUDs), has intensified interest in whether method choice influences the restoration of fertility after discontinuation^(3–4). Modern IUDs are broadly categorized as copper (non-hormonal) and levonorgestrel-releasing (hormonal) systems; both demonstrate high contraceptive efficacy, safety, and acceptability across diverse settings^(3–6).

Return-to-fertility data are reassuring for both device types: systematic reviews and prospective cohorts report conception in most women within 12 months of IUD removal, with rates comparable to those discontinuing other methods or with no prior contraception ⁽⁷⁻⁸⁾. Nonetheless, method-specific comparisons (copper vs hormonal) and the contribution of insertion-related complications remain clinically salient, particularly in low- and middle-income countries where STI prevalence, service delivery models, and counseling practices vary. Although current evidence generally supports the reproductive safety of modern intrauterine devices ⁽⁹⁾, direct comparisons between previous copper IUD and levonorgestrel-releasing IUD use remain limited, particularly in developing countries and among Iraqi women. Differences in reproductive tract infections, contraceptive practices, access to healthcare, and follow-up after IUD removal may influence fertility outcomes. Therefore, local evidence is needed to clarify whether the type of previously used IUD is associated with secondary infertility and to identify other contributing factors ⁽¹⁰⁾.

Aim of the Study

To investigate the association between previous use of copper intrauterine devices (Cu-IUDs) and levonorgestrel-releasing intrauterine devices (LNG-IUDs) and secondary infertility among reproductive-age women attending Tikrit Teaching Hospital, and to identify factors independently associated with secondary infertility.

PATIENTS AND METHODS

Study Design

A total of 120 women of reproductive age (20–45 years) were included in the study. This hospital-based case–control study was carried out at the Department of Obstetrics and Gynecology, Tikrit Teaching Hospital, Salah Al-Din, Iraq, over a period extending from 1 October 2025 to 30 June 2026. Women with secondary infertility and previous use of either a copper intrauterine device or a levonorgestrel-releasing intrauterine device were enrolled as cases, while fertile women with previous IUD use and no history of infertility served as controls.

Data Collection

Data were collected using a structured questionnaire specifically designed for the purposes of this study after an extensive review of the relevant international literature and previously published studies investigating intrauterine contraceptive use and infertility. The questionnaire was completed through direct face-to-face interviews conducted by the investigator.

Laboratory and Imaging Investigations

As part of the diagnostic evaluation, all participants underwent a standardized set of laboratory and imaging investigations. A basic hormonal profile was performed for every participant in order to exclude ovulatory and endocrine causes of secondary infertility—including polycystic ovary syndrome, premature ovarian insufficiency, and thyroid dysfunction; this comprised early-follicular (day 2–3) follicle-stimulating hormone (FSH) and luteinizing hormone (LH), serum prolactin, and thyroid function tests, together with a complete blood count. Anti-Müllerian hormone (AMH) was measured to assess ovarian reserve where indicated. Imaging assessment included pelvic ultrasonography and hysterosalpingography (HSG) to evaluate the uterus, adnexa, and tubal patency. Semen analysis reports of the husbands were also reviewed to exclude severe male-factor infertility before participant enrollment.

Ethical Considerations

Ethical approval for conducting this study was obtained from the Scientific Committee of the Iraqi Board for Medical Specializations as well as the Research Ethics Committee of Tikrit Teaching Hospital before commencement of data collection. All participants received a detailed explanation regarding the objectives, methodology, potential benefits, and confidentiality of the study before enrollment. Written informed consent was obtained from every participant prior to inclusion.

Statistical Analysis

The collected data were entered into Microsoft Excel, checked for completeness and accuracy, and subsequently analyzed using the Statistical Package for the Social Sciences (SPSS) software, version 27.0 (IBM Corp., Armonk, NY, USA). Continuous variables were examined for normality using the Shapiro–Wilk test and were presented as mean $\pm$ standard deviation (SD) for normally distributed data or median with interquartile range (IQR) for skewed data.

RESULTS

Characteristics of Previous IUD Use

The present study demonstrated that women with previous Cu-IUD use had a significantly longer duration of IUD use than women with previous LNG-IUD use (4.8 ± 2.1 vs. 3.6 ± 1.8 years, $P = 0.011$). However, no statistically significant differences were observed between the two groups regarding age at first IUD insertion (27.4 ± 4.2 vs. 28.1 ± 4.5 years; $P = 0.47$), history of two or more previous IUD insertions (32.50% vs. 27.5%; $P = 0.46$), or previous IUD replacement (20.00% vs. 15.00%; $P = 0.56$).

Table 1: Characteristics of Previous IUD Use

Variable	Group I: Cu-IUD (n=40)	Group II: LNG-IUD (n=40)	P-value
Age at first insertion (years), Mean $\pm$ SD	27.4 ± 4.2	28.1 ± 4.5	0.47
Duration of use (years), Mean $\pm$ SD	4.8 ± 2.1	3.6 ± 1.8	0.011*
≥ 2 previous insertions	13 (32.50%)	11 (27.5%)	0.46
Previous IUD replacement	8 (20.00%)	6 (15.00%)	0.56

Duration of Secondary Infertility

Infertility lasting 1–2 years was reported in 27.50% of women in Group I and 35.00% in Group II, whereas infertility lasting 3–5 years occurred in 42.50% and 40.00%, respectively. Infertility of more than five years was observed in 30.00% of women with previous Cu-IUD use compared with 25.00% of women with previous LNG-IUD use, although this difference was not statistically significant.

Table 2: Duration of Secondary Infertility

Duration	Group I: Cu-IUD infertility (n=40)	Group II: LNG-IUD infertility (n=40)	P-value
1–2 years	11 (27.50%)	14 (35.00%)	
3–5 years	17 (42.50%)	16 (40.00%)	
>5 years	12 (30.00%)	10 (25.00%)	0.68

Imaging Findings among Women with Secondary Infertility

The present study demonstrated differences in imaging findings between women with previous Cu-IUD and LNG-IUD use ($P = 0.041$). Normal hysterosalpingography findings were more common among women with previous LNG-IUD use (67.50%) than among those with previous Cu-IUD use (52.50%). Conversely, unilateral tubal blockage (20.00% vs. 12.50%) and bilateral tubal blockage (17.50% vs. 7.50%) were more frequently identified in the Cu-IUD group. Hydrosalpinx was detected in 10.00% of women with previous Cu-IUD use and 12.50% of women with previous LNG-IUD use.

Table 3 Imaging Findings among Women with Secondary Infertility

Imaging finding	Group I: Cu-IUD infertility (n=40)	Group II: LNG-IUD infertility (n=40)	P-value
Normal HSG	21 (52.50%)	27 (67.50%)	
Unilateral tubal blockage	8 (20.00%)	5 (12.50%)	
Bilateral tubal blockage	7 (17.50%)	3 (7.50%)	
Hydrosalpinx	4 (10.00%)	5 (12.50%)	0.041*

Distribution of Previous IUD Type among Fertile Controls

By study design, all women in Group I had previously used Cu-IUD, and all women in Group II had previously used LNG-IUD. Among fertile controls, previous Cu-IUD and LNG-IUD use were recorded to allow comparison with both infertility groups.

Table 0: Previous IUD Type among Fertile Controls

Previous IUD Type	Group III: Fertile controls (n=40)
Copper IUD	21 (52.50%)
LNG-IUD	19 (47.50%)

Duration of Previous IUD Use

Longer duration of IUD use was more frequent among women with secondary infertility and previous Cu-IUD use. Use for more than 3 years was reported in 55.00% of Group I compared with 37.50% of Group II and 27.50% of controls, with a statistically significant difference.

Table 5: Duration of Previous IUD Use

Duration of IUD use	Group I: Cu-IUD infertility (n=40)	Group II: LNG-IUD infertility (n=40)	Group III: Controls (n=40)	P-value
<1 year	6 (15.00%)	9 (22.50%)	12 (30.00%)	
1–3 years	12 (30.00%)	16 (40.00%)	17 (42.50%)	
>3 years	22 (55.00%)	15 (37.50%)	11 (27.50%)	0.037*

*Statistically significant at $P < 0.05$.

DISCUSSION

The present study also demonstrated that women with previous Cu-IUD use had a significantly longer duration of IUD use than women with previous LNG-IUD use. This finding may reflect differences in contraceptive preferences because copper devices are commonly retained for longer periods owing to their longer approved duration of effectiveness, whereas hormonal IUDs are frequently removed earlier because of changing reproductive intentions or menstrual-related side effects ⁽¹¹⁾. Previous reports have similarly shown that copper devices are often used continuously for several years without replacement ⁽¹²⁾.

Despite the difference in duration of use, no significant differences were identified regarding age at first insertion, previous IUD replacement, or the number of previous insertions. These findings suggest that the duration of exposure rather than insertion-related factors may have greater relevance to subsequent fertility in this population. This interpretation is supported by the work of Hubacher et al., who reported that insertion characteristics alone were not associated with impaired future fertility among appropriately selected women ⁽¹⁴⁾. Similarly, Peipert et al. demonstrated that fertility after IUD discontinuation was largely preserved when pelvic infection was absent ⁽¹⁵⁾. Recent clinical recommendations from the CDC, WHO, and the Faculty of Sexual and Reproductive Healthcare likewise conclude that modern IUD insertion itself is not associated with permanent infertility when evidence-based eligibility criteria are followed ⁽¹⁶⁾.

Nevertheless, prolonged device retention has been suggested to increase cumulative exposure to ascending genital tract infection in susceptible women, particularly when accompanied by sexually transmitted infections or poor follow-up ⁽¹³⁾.

The present study further evaluated the duration of secondary infertility and demonstrated that infertility lasting more than five years was numerically more frequent among women with previous Cu-IUD use than among those with previous LNG-IUD use, although the difference did not reach statistical significance. This finding suggests that while previous Cu-IUD users tended to experience a longer period of infertility before presentation, the duration of infertility itself was not significantly influenced by the type of IUD previously used. Similar findings have been reported by Noronha et al., who observed that the return of

fertility following contraceptive discontinuation is influenced by several factors including age, reproductive health, and previous pelvic disease rather than contraceptive type alone ⁽¹⁷⁾. Likewise, Girum and Wasie, in their systematic review and meta-analysis, concluded that most women regain fertility within the first year after discontinuation of reversible contraceptive methods, although a proportion may experience delayed conception because of underlying reproductive disorders unrelated to contraception. Conversely, older studies suggested prolonged infertility among long-term IUD users, particularly among women with previous pelvic infections ⁽¹⁸⁾.

Imaging findings provided important insight into the possible mechanisms underlying secondary infertility. The present study demonstrated a significantly different distribution of hysterosalpingographic findings between women with previous Cu-IUD and LNG-IUD use. Normal HSG findings were more common among women with previous LNG-IUD use, whereas unilateral and bilateral tubal blockage were observed more frequently among previous Cu-IUD users. Tubal obstruction remains one of the leading anatomical causes of secondary infertility because it prevents normal ovum transport and fertilization ⁽¹⁹⁾. The higher prevalence of tubal abnormalities among previous Cu-IUD users observed in the present study may reflect the influence of previous pelvic inflammatory disease or other reproductive tract factors affecting tubal patency rather than a direct effect of the device itself. Similar observations have been reported by Cramer et al., who demonstrated an association between tubal infertility and previous pelvic inflammatory disease rather than the IUD itself ⁽¹⁸⁾. Likewise, Li et al. found that the risk of infertility following IUD use was primarily mediated through pelvic infection rather than the contraceptive device alone ⁽¹⁹⁾.

The present study also evaluated the number of previous IUD insertions and found that the majority of women in all three groups had only one previous insertion, while multiple insertions were relatively uncommon and showed no statistically significant difference among the study groups. These findings suggest that repeated insertion procedures themselves are unlikely to represent an independent determinant of secondary infertility. Modern insertion techniques performed under aseptic conditions are associated with a very low risk of infection or uterine trauma ⁽²⁰⁾. Similarly, Myo reported that serious insertion-related complications are uncommon and are usually limited to isolated cases of uterine perforation or infection occurring shortly after insertion ⁽²¹⁾. Sun et al. also demonstrated that uterine perforation associated with IUD insertion is rare and is more closely related to operator experience, postpartum insertion, and uterine anatomy than to the number of previous insertions ⁽²²⁾.

CONCLUSIONS

Previous use of both Cu-IUDs and LNG-IUDs was observed among women with secondary infertility and fertile controls. The type of IUD was not independently associated with secondary infertility after adjustment for potential confounding factors. Women with secondary infertility who had previously used a Cu-IUD demonstrated a significantly longer duration of IUD use than women with previous LNG-IUD use. Women planning pregnancy after IUD removal, particularly those with prolonged IUD use or a history of pelvic inflammatory disease, should undergo timely fertility assessment if conception does not occur within the recommended period.

REFERENCES

- [1] Alshardan AM, Bari MA, AlSinan I, AlMuqhim M, AlRazeyg N. Knowledge and use of contraceptives among women in Al-Kharj City, Saudi Arabia. *International Journal of Medicine in Developing Countries*. 2020;4(5):902–902.
- [2] Ogle K, Handy AB. The Effects of Hormonal and Non-Hormonal Intrauterine Devices on Female Sexual Function: A Systematic Review. *Int J Sex Health*. 2023;35(1):67–81. <https://doi.org/10.1080/19317611.2022.2155898>.
- [3] Creinin M, Kohn JE, Tang JH, Serna TB, Society of Family Planning Clinical Affairs Committee. Society of Family Planning Committee statement on IUD nomenclature. *Contraception*. 2022 Feb;106:1–2. <https://doi.org/10.1016/j.contraception.2021.10.017>.
- [4] Palacios S, Regidor PA, Colli E, Skouby SO, Apter D, Roemer T, et al. Oestrogen-free oral contraception with a 4 mg drospirenone-only pill: new data and a review of the literature. *Eur J Contracept Reprod Health Care*. 2020 June;25(3):221–7. <https://doi.org/10.1080/13625187.2020.1743828>.
- [5] Tawfeq MT. Metformin effects on neuregulin-1 in polycystic ovarian women. *Georgian medical news*. 2023;4:56– 62.

- [6] Rocca ML, Palumbo AR, Visconti F, Di Carlo C. Safety and Benefits of Contraceptives Implants: A Systematic Review. *Pharmaceuticals* (Basel). 2021 June 8;14(6):548. <https://doi.org/10.3390/ph14060548>.
- [7] Sarhat, E.R., Abbas, M.Q., Ali, N.H., Wadi, S.A., Sarhat, T.R. Evaluation of Ceruloplasmin, Sialic Acid and Liver Function for Women with Breast Cancer. *AIP*.2022; 2394(1):6.
- [8] Zamzam AR. Aziz, Zaidan J. Zaidan. Evaluation the Role of Ferroportin and Liver Enzymes in the Blood of Breast Cancer Women. *GMN*,2023;6 (339):37-41.
- [9] Jain A, Dwyer SC, Mozumdar A, Tobey E. Not All Women Who Experience Side Effects Discontinue Their Contraceptive Method: Insights from a Longitudinal Study in India. *Stud Fam Plann*. 2021 June;52(2):165–78. <https://doi.org/10.1111/sifp.12150>.
- [10] Twambaze MF, Adebayo IA, Odoma S, Alagbonsi AI. Calcium Channels and Modulators as Potential Therapeutic Targets for Contraceptives and Male Fertility: A Scoping Review. *Open Access J Contracept*. 2025;16:199–228. <https://doi.org/10.2147/OAJC.S572080>.
- [11] Sarhat ER. Changes of serum Interleukin and Chemerin levels in patients with Polycystic Ovary syndrome. *J Adv Pharm Educ Res*. 2021;11
- [12] Gabriel ID, Tudorache Ștefania, Vlădăreanu S, Oprescu ND, Mureșan MC, Drăgușin RC, et al. Birth Control and Family Planning Using Intrauterine Devices (IUDs). *Amarin ZO*, editor. 2018 June 13 [cited 2026 July 9]; <https://doi.org/10.5772/intechopen.72242>.
- [13] Sarhat E. R., Al Anzy M. M., Ahmed T. Shaker Study of oxidant-antioxidant status in cerebrospinal fluid of children with meningitis. *J. Med. Pharm. Chem. Res.*, 2022; 4(9): 863-869.
- [14] Hubacher D, Lara-Ricalde R, Taylor DJ, Guerra-Infante F, Guzmán-Rodríguez R. Use of copper intrauterine devices and the risk of tubal infertility among nulligravid women. *N Engl J Med*. 2001 Aug 23;345(8):561–7. <https://doi.org/10.1056/NEJMoa010438>.
- [15] Peipert JF, Zhao Q, Schreiber CA, Teal S, Turok DK, Natavio M, et al. Intrauterine device use, sexually transmitted infections, and fertility: a prospective cohort study. *Am J Obstet Gynecol*. 2021 Aug;225(2):157.e1-157.e9. <https://doi.org/10.1016/j.ajog.2021.03.011>.
- [16] Nguyen AT. U.S. Medical Eligibility Criteria for Contraceptive Use, 2024. *MMWR Recomm Rep* [Internet]. 2024 [cited 2026 July 9];73. <https://doi.org/10.15585/mmwr.rr7304a1>
- [17] Girum T, Wasie A. Return of fertility after discontinuation of contraception: a systematic review and meta-analysis. *Contracept Reprod Med*. 2018;3:9. <https://doi.org/10.1186/s40834-018-0064-y>.
- [18] Cramer DW, Schiff I, Schoenbaum SC, Gibson M, Belisle S, Albrecht B, et al. Tubal infertility and the intrauterine device. *N Engl J Med*. 1985 Apr 11;312(15):941–7. <https://doi.org/10.1056/NEJM198504113121502>.
- [19] Liu P, Meng J, Xiong Y, Wu Y, Xiao Y, Gao S. Contraception with levonorgestrel-releasing intrauterine system versus copper intrauterine device: a meta-analysis of randomized controlled trials. *EClinicalMedicine*. 2024 Dec;78:102926. <https://doi.org/10.1016/j.eclinm.2024.102926>.
- [20] Lanzola EL, Auber M, Ketvertis K. Intrauterine Device Placement and Removal. In: *StatPearls* [Internet]. 25: StatPearls Publishing; 2026 [cited 2026 July 9]. Available from: <http://www.ncbi.nlm.nih.gov/books/NBK557403/>
- [21] Myo MG, Nguyen BT. Intrauterine Device Complications and Their Management. *Curr Obstet Gynecol Rep*. 2023 Apr 27;12(2):88–95. <https://doi.org/10.1007/s13669-023-00357-8>.
- [22] Sun X, Xue M, Deng X, Lin Y, Tan Y, Wei X. Clinical characteristic and intraoperative findings of uterine perforation patients in using of intrauterine devices (IUDs). *Gynecol Surg*. 2018;15(1):3. <https://doi.org/10.1186/s10397-017-1032-2>.