

# Review Article on Intra Uterine Devices

G. Sindhu Sravanthi<sup>1</sup>, B. Mohammad Rasheed<sup>2</sup>, M. Tejaswi<sup>3</sup>, J.N. Suresh Kumar<sup>4</sup>

<sup>1,2,3,4</sup> Department of Pharmaceutics, Narasaraopeta Institute of Pharmaceutical Sciences, Narasaraopet, Kotappakonda Road, Guntur (dts)

---

## ABSTRACT

An intrauterine device is a special device that fits inside of uterus. Contraceptive device is the most common used method of contraception in many countries. The IUDs are a long acting reversible method of contraception. Despite the availability of many generations of IUDs with variable shapes and configuration, side effects and complications are frequent. Evidence – based practices have increased the number of women who are medically eligible for IUDs and have enabled more rapid access to the methods. Currently hormonal IUDs are available in the market. Each IUD is extremely effective, convenient, and safe. The newer IUDs have been tested in populations not usually included in clinical trials and provide reassuring answers to older concern about IUD use in these women, including information about expulsion, infection, and discontinuation. On the other hand, larger surveillance studies have provided New estimates about the risks of complications such as perforations, especially In postpartum and breastfeeding women.

**Keywords:** Intrauterine contraceptive device, contraception, infection.

---

## INTRODUCTION

Intrauterine devices (IUD) is a small object that is inserted through the cervix and placed in the uterus to prevent pregnancy. A small string hangs down from the IUD into the upper part of the vagina. The IUD is not noticeable during intercourse. IUDs can last 1-10 years. They affect the movement of eggs and sperm to prevent fertilization. They also change the lining of the uterus and prevent implantation. IUDs are 99.2-99.9% effective as birth control. They do not protect against sexually transmitted infections, including HIV/AIDS. Insertion of an IUD takes only about 5 to 10 minutes.

An IUD prevents pregnancy by stopping sperm from reaching an egg that from ovaries. IUDs are the most effective from of nonpermanent birth control. They are more than 99% effective. An intrauterine device usually is a small, flexible plastic frame. It often has copper wire or copper sleeves on it. It is inserted into a women's vagina through her uterus. Almost all brands of IUDs have two strings, or threads tied to them. The strings hang through the opening of the cervix into the vagina. A provider can remove the IUD by pulling gently on the strings with forceps.

### Advantages

1. Highly effective in preventing pregnancy
2. Can be used for a long period of time
3. IUDs are Inexpensive, safe, convenient, effective and reversible.
4. It does not require parents' involvement
5. Minimal systemic side effects, an increase in bioavailability.
6. It can be used as an emergency method of birth control.
7. It is inexpensive.
8. Quick onset of action.

### Disadvantages

1. It does not protect against sexually transmitted infection
2. Pain & heavy menstrual bleeding mostly with first generation IUDs which decreases with usage.
3. It can cause heavier and more painful periods
4. If the IUD has not been inserted properly, then it may perforate the uterus leading to further complication.

5. Cramping and discomfort occurs during and 24-48 hours after insertion.

#### Anatomy of uterus

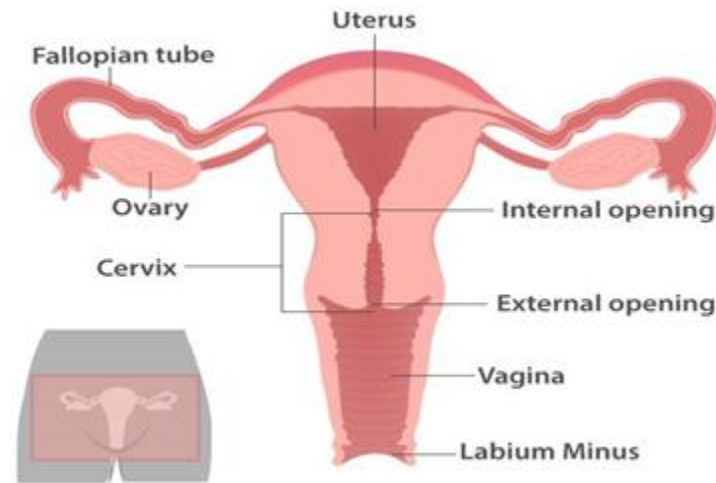


Figure No: 1.1 Anatomy of uterus

- The uterus is a pear shaped; thick walled, muscular organ suspended in the anterior wall of pelvic cavity.
- In its normal state, it measures about 3 inches long and 2 inches wide.
- Fallopian tubes enter its upper portion, one on each side, and the lower portion of the uterus projects into the vagina.
- The uterine cavity is normally triangular in shape and flattened anterioposteriorly.
- The wall of the uterus consists of 3 layers.
  1. Endometrium
  2. Myometrium
  3. Peritoneum.

#### Endometrium

Inner coat of the uterine wall and is a mucous membrane. It consists of epithelium lining and connective tissue. Epithelium consists of non-cornified stratified squamous, Epithelium, and lamina propria.

Superficial – large, flat cells.

Intermediate – large flatter nucleated cells.

Paranasal – polyhedral cells.

Monolayer – cuboidal basal cells closely apposed to basement membrane.

Connective tissue consists of two types of arteries which supply blood to the endometrium – straight arteries supply the deeper layer, the coiled arteries supply the superficial layer.

#### Myometrium

Thick, muscular middle layer made up of bundles of interlaced, smooth muscle fibers embedded in connective tissue. It is containing large blood vessels of uterine walls.

#### Peritoneum

External surface of the uterus, which is attached to the both sides of the pelvic cavity by broad ligaments through which the uterine arteries cross.

#### Types of IUD

An IUD is a tiny device that's inserted into uterus to prevent pregnancy. It's long term reversible and one of the most effective birth control methods out there. On the basis of material used, generation wise intrauterine devices are classified into 3 different types.

1. First generation IUDs: plastic devices.
2. Second generation IUDs: copper bearing devices
3. Third generation IUDs: steroid medicated devices.

### First generation IUDs: plastic devices

The first-generation IUDs represented by the “Margulies spiral”. Was introduced in 1960. After many experiments, DrJack Lippes invented the double-s Loop (the Lippes loop) in 1962. Plastic intrauterine devices are 2 types.

- Lippes’s loop
- Dalkon shield

### Lippes’s loop

Lippes’s loop was made from polyethylene, with barium sulphate added for visibility under X- rays, and was available in four sizes, from A to D.

This IUD was the first to have nylon thread attached to the lowest part of the device ; this made it easily to remove, and it was also possible to verify by simple vaginal examination that the IUD was in the uterine cavity. It became the standard inert device; all the major studies on the IUD were made using this device. The lippes loop was to become extremely popular and, of all the first-generation IUDs, had the greatest worldwide impact.



Figure No: 1.2 Lippes’s loop

### Dalkon shield

Dalkon shield develop by Dr Hugh Davis, and released in 1971. The Dalkon shield was a plastic device which looked around bug with one large eye and five legs on each side. It has a unique tail not a single filament, but many fines wound together and enclosed in a sheath. Because the Dalkon shield’s unique shape made it difficult to remove, a multi filament string was used to provide increased tensile strength during removal. The multi filament tail string, unique to the Dalkon shield, was most probably responsible for the facilitated ascent of bacteria from the vagina upward into the uterine cavity, causing pelvic infection shortly after it’s release, reports of septic abortion and other infections reached a serious level.

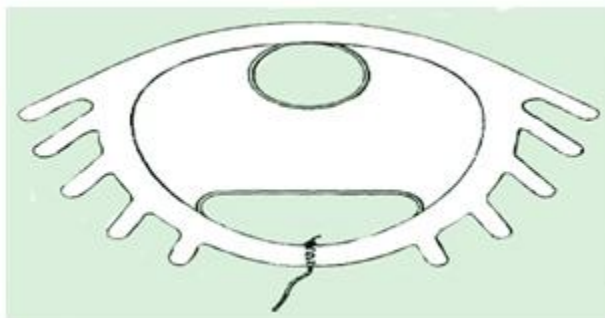


Figure No: 1.3 Dalkon shield

### Second generation IUDS: copper bearing devices

The development of the first copper - bearing IUD was announced in 1969 by Dr Jaime zipper and DrHoward Tatum. Small T-shaped IUD is most appropriate and on account of the “fundal- seeking effect”, the T-shaped device would be less prone to expulsion. A copper placement with a free surface of 200 mm <sup>2</sup> was optimal in terms of contraceptive efficacy.

- **Copper bearing IUDs:** Copper wire or copper sleeves are put on the plastic frame (poly ethylene frame). Examples include copperT, CuT380A, Multiload 375 Etc.



Figure No: 1.4 Copper Iud

**TCu200:** The first copper- bearing IUD, the TCu200 was produced in 1969. Using a T- carrier, with the addition of 200mm<sup>2</sup> copper wire, reduced the pregnancy rate from 18 per 100 woman years with the plain T carries to 18 per 100 women years with the plain T carries to 1 per 100 women years.

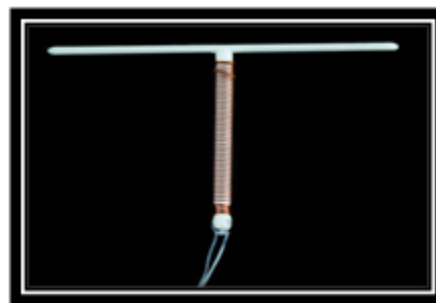


Figure No: 1.5 TCu200

**Multiload device (MLCU—250 MLCU –375):** The Multiload series of devices were designed to reduce the incidence of expulsion by the addition of plastic fins on the lateral, curved arms. Copper wire is wound onto the central stem of the device. The **MLCu -250** was the first version, available in 3 sizes (standard, mini, short), to allow insertion into different sized uteri, including the nulliparous. The **MLCu-375** followed, with more copper to enhance efficacy and length of use. The lower copper-load versions are licensed for 3 years use and MLCu-375 model for 5 years. The multiload 375 and Tcu – 380 A are similar in their efficacy and performance.

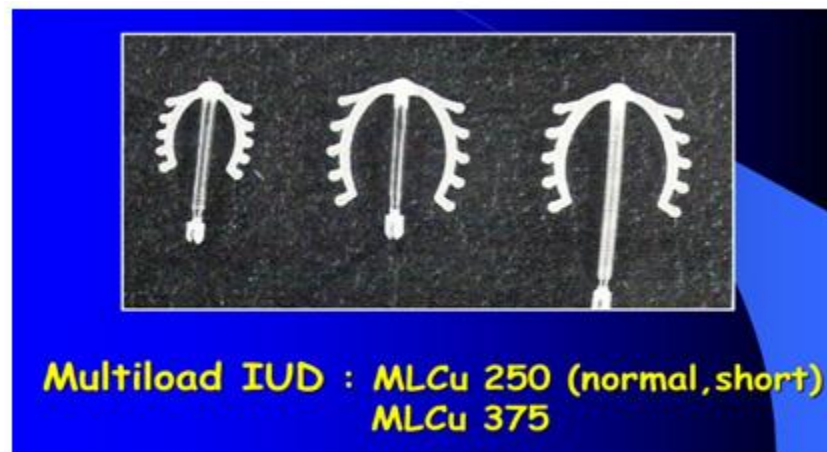


Figure No: 1.6 Multiload device (MLCu-250&MLCu-375)

**TCu-220C:** TCu-220C model is of particular interest, because, in carrying copper collars of a copper placement, metal loss was prevented.



Figure No: 1.7 TCu-220C

**TCu-380A:** It is a T shaped device with a polyethylene frame holding 380mm<sup>2</sup> of exposed surface area of copper. The IUD frame contains barium sulfate thus making it radiopaque.

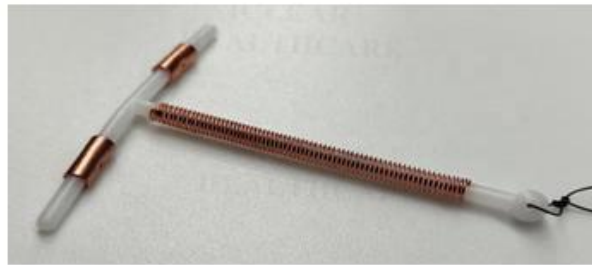


Figure No: 1.8 Tcu-380A

**TCu-380-Ag:** It is identical to 380A except that the copper wire on the stem has a silver core to prevent fragmentation and extend the life span of the copper.



Figure No: 1.9 TCu-380 Ag

**CuT380 Slimline:** It has copper sleeves flushed at the ends of horizontal arms to facilitate easier load in and insertion. The performance of CuT-380 Ag and the CuT-380 simline is equal to that of CuT- 380A.



Figure No: 1.10 CuT 380 Slimline

### **Mechanism of action**

The copper IUD functions as a contraceptive (inhibiting fertilization). Ova retrieved at the time of tubal sterilization performed following timed intercourse midcycle showed no normal division of the ova, which might have indicated union of the gametes. On the other hand, the inflammatory changes in endometrium do have spermicidal activity. In vitro, copper ions in concentrations typical of those found within the endometrial cavity with the CuT-380A IUD inhibit sperm mobility and block activation of acrosomal enzymes in the sperm head needed for the sperm to penetrate through the zona pellucida to enable union of the gametes. These observations lead to the characterization of copper IUDs used for pregnancy prevention as “functional spermicides”. The copper slows down the movement of sperm within the woman’s uterus and so prevents them from reaching the fallopian tubes and fertilizing the egg. The device also stimulates a strong reaction in the wall of the uterus, which prevents implantation of the egg.

### **Effectiveness of IUDs**

An IUD is a highly effective, long term, reversible contraception. Using an IUD can be as effective as female surgical sterilization in preventing pregnancy, but unlike sterilization it is a completely reversible contraceptive method. Among women who use the copper T380A IUD, less than 1% becomes pregnant (0.6 to 0.8 per 100 women) during the first year of use. Additionally, the cumulative risk of pregnancy over then 10 years service life of an IUD is less than 3%. In addition, fertility returns soon after removal. The copper T 380A can prevent a woman from becoming pregnant for up to 12 years. However, its effect is reduced after 7 years of use, after which the likelihood of becoming pregnant increases.

### **Side Effects**

IUDs cause very few side effects. The most common are pelvic cramping and menstrual problems, including heavy and prolonged menstrual bleeding, and intermenstrual spotting. Although abnormal bleeding and spotting are the leading reasons for women to discontinue the method, these side-effects do not usually affect their health, and generally decrease in the first few months after insertion.

### **Third generation IUDs: steroid medicated devices**

Dr Antonio Scommegna, demonstrated the uterine effects of progesterone in the late 1960s, and postulated that the endometrial atrophy elicited by the natural hormone would be useful in preventing implantation and reducing menstrual bleeding. He developed a hormone releasing device and showed that it is as effective in preventing pregnancy as the copper – bearing IUD.

A device is T-shaped, consisting of a permeable polymer membrane which releases progesterone at a predictable, controlled rate of 65 Mg per 24 hours over the period of a year. The levonorgestrel releasing intrauterine system (LNG-IUS) is a T-shaped polyethylene device with a steroid reservoir around the vertical stem. The cylindrical reservoir contains a mixture of silicone (polymethyl siloxane) and 52 mg levonorgestrel, a progestin widely used in implants, oral contraceptives, and vaginal rings. The reservoir is covered by a silicone membrane, and the frame contains barium sulphate, which makes radiopaque. A monofilament removal thread is attached to a loop at the end of the vertical stem. The LNG IUS is licensed for 5 years use.

**Menstrual irregularity** – Mostly frequent, irregular spotting is common in the first few months after LNG IUS insertion. From the fourth month onwards a profound reduction in menstrual blood loss (MBL) is typical. The tissue concentration of LNG in the endometrium during LNG IUS use far exceeds that found with high systemic doses of levonorgestrel.

### **Mechanism of Action**

The IUD induces an intense local inflammatory response, especially by the copper containing devices, which in turn leads to lysosomal activation and other inflammatory changes that are spermicidal. Whenever fertilization occurs, the same inflammatory action is directed against the developing embryo. Inert devices, such as the Lippes-loop, are more effective with increased size and extent of contact with endometrium. Certain metals, especially copper, greatly enhance the contraceptive action of inert devices, probably by inducing a more intense local intrauterine inflammatory response. The progesterone carrying devices include atrophic endometrial changes which make the endometrium a hostile site for implantation if fertilization and successful tubal transport have occurred.

It is not possible to demonstrate a single mode of action of the levonorgestrel releasing IUS. Scanty cervical mucus and strong suppression of the endometrium is the main factors behind the contraceptive action of the device. The local effect of progesterone causes the cervical mucus to thicken.



Other suggested mechanisms to prevent conception are inhibition of sperm mobility and function inside the uterus and in the fallopian tubes, preventing fertilization and endometrial growth, even though ovulation is inhibited in some women, it is not believed that it has a major effect on contraceptive efficacy. A foreign body effect, similar to that of other intrauterine contraceptive devices, is also present.

### CONCLUSION

An IUD is inserted into the uterus (Womb) by a health-care provider with specialized training. An IUD prevents pregnancy by stopping sperm from reaching an egg that from ovaries have released. An IUD also changes the lining of the uterus so an egg does not implant in the lining if it has been fertilized. Therefore, the egg has no place to grow. Copper IUDs are not recommended for women with Wilson's disease or allergies to copper. Women with a history of breast cancer cannot use the Mirena IUD. An IUD is a good option for women who want a highly effective, long term, easily reversible method of contraception.

### REFERENCES

- [1]. American College of Obstetricians and Gynaecologists. ACOG Practice Bulletin No. 121: Long-acting reversible contraception: implants and intrauterine devices. *Oster Gynecol.* 2011; 118(1):184-196.
- [2]. United Nations Dev. Long-term reversible contraception. Twelve Years of experience with the TCu380A and TCu220C. *Contraception.* 1997; 56(6):341-352. 3. Thonneau PF, Almont T. Contraceptive efficacy of intrauterine devices. *Am J Obstet Gynecol.* 2008;198(3):248-253.
- [3]. Ortiz ME, Croxatto HB. The mode of action of IUDs. *Contraception.* 1987;36(1):37-53.
- [4]. Trussell J. Contraceptive failure in the United States. *Contraception.* 2011;83(5):397-404.
- [5]. Sivin I, Stem J, Diaz S, et al. Rates and outcomes of planned pregnancy after use of Norplant capsules, Norplant II rods, or levonorgestrel-releasing or copper TCu 380Ag intrauterine contraceptive devices. *Am J Obstet Gynecol.* 1992;166(4):1208-1213.
- [6]. Nelson AL, Massoudi N. New developments in intrauterine device use: focus on the US. *Open Contraception,* 2016;7:127-141. Access Journal of Trussell J. Update on and correction to the cost effectiveness of contraceptives 2012;85(2):218. In the United States. *Contraception.*
- [7]. Stanford JB, Mikolajczyk RT. Mechanisms of action of intrauterine devices: update and estimation of postfertilization effects. *Am J Obstet Gynecol.* 2002; 187(6):1699-1708.
- [8]. Alvarez F, Brache V, Fernandez E, et al. New insights on the mode of action of intrauterine contraceptive devices in women. *Fertil Steril.* 1988; 49(5):768-773.
- [9]. Johnson BA. Insertion and removal of intrauterine devices. *Am Fam Physician.* 2005; 71(1):95-102. 12. Grimes DA, Lopez LM, Schulz KF, Van Vliet HA, Stanwood NL. Immediate post-partum insertion of intrauterine devices. *Cochrane Database Sys Rev.* 2010;(5) CD003036.
- [10]. Chen BA, Reeves MF, Hayes JL, Hohmann HL, Perriera LK,
- [11]. International Medical Advisory Panel. IMAP statement on intrauterine devices. *IPPF Med Bull,* 2003,37(2):1-4.
- [12]. Tyler CP, Whiteman MK, Zapata LB, Curtis KM, Hillis SD, Marchbanks PA. Health care provider attitudes and practices related to intrauterine devices for nulliparous women. *Obstet Gynecol.* 2012,119(4):762-771.
- [13]. Hubacher D. Copper intrauterine device use by nulliparous women: review of side effects. *Contraception.* 2007;75(6 suppl):S8-S11,
- [14]. Paterson H, Ashton J, Harrison-Woolrych M. A nationwide cohort study of the use of the levonorgestrel intrauterine device in New Zealand adolescents. *Contraception.* 2009,79(6):433-438.
- [15]. Veldhuis HM, Vos AG, Lagro-Janssen AL. Complications of the intrauterine device in nulliparous and parous women. *Eur J Gen Pract.* 2004;10(3):82-87.
- [16]. Suhonen S, Haukkamaa M, Jakobsson T, Rauramo I. Clinical performance of a levonorgestrel-releasing intrauterine system and oral contraceptives in young nulliparous women: a comparative study. *Contraception.* 2004, 69(5):407-412.
- [17]. Centers for Disease Control and Prevention. U.S. Medical eligibility criteria for contraceptive use, 2010. *MMWR Recomm Rep.* 2010, 59(RR-4):1-86.
- [18]. Campbell SJ, Cropsey KL, Matthews CA. Intrauterine device use in a high-risk population: experience from an urban university clinic. *Am J Obstet Gynecol.* 2007; 197(2): 193, el-193.c6.
- [19]. Mohllajee AP, Curtis KM, Peterson HB. Does insertion and use of an intrauterine device increase the risk of pelvic inflammatory disease among women with sexually transmitted infection? A systematic review. *Contraception.* 2006; 73(2):145-153.
- [20]. Winner B, Peipert JF, Zhao Q, et al. Effectiveness of long-acting reversible contraception. *N Engl J Med.* 2012; 366(21):1998-2007. 26 Tavakolian S, Doulabi MA, Baghban AA, Mortazavi A, Ghorbani.