Intrauterine contraception: Background and device types

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INTRODUCTION

The intrauterine device (IUD) is the most commonly used method of long-acting reversible contraception because of its high efficacy and safety, ease of use, and cost effectiveness. It provides a nonsurgical option for pregnancy prevention that is as effective as surgical sterilization. The most frequently used IUDs have a plastic frame and release either copper or a progestin to enhance the contraceptive action of the device.

Several terms are used to describe IUDs, including IUD and intrauterine contraception; the hormonal IUD or progestin-containing device is also referred to as an intrauterine system. In this topic, we use the term IUD for all types of IUDs.

This topic will discuss types of IUDs and their mechanism of action. Issues related to IUD selection, use in specific populations, removal, side effects, and complications are discussed separately:

- (See "Intrauterine contraception: Candidates and device selection".)
- (See "Intrauterine contraception: Insertion and removal".)
- (See "Intrauterine contraception: Management of side effects and complications".)

BACKGROUND

Prevalence of use — The IUD is the most commonly used method of reversible contraception worldwide and is used by an average of 23 percent of female contraceptive users, with a range of

<2 to >40 percent depending on the country [1,2]. In 2014, IUDs were used by 27 percent of female contraceptive users in Asia and 17 percent of female contraceptive users in Europe [2]. Use of IUDs has increased in the United States: Between 2002 and 2014, IUD use rose from 2 to 14 percent among United States women using contraception [3-7]. Actively informing women about benefits, risks, and common side effects of IUDs appears to improve consideration and acceptance of the method [8,9].

Types of IUDs — Two types of IUDs are available in the United States, copper containing and levonorgestrel (LNG) releasing:

- **Copper IUD** – The copper IUD is a T-shaped device which contains 380 mm^2 copper (abbreviated TCu380A, commercial name ParaGard) [10]. It is approved by the US Food and Drug Administration (FDA) for 10 years of use. There are other copper-containing IUDs, but none are currently FDA approved for use in the United States. (See 'Copper IUD' below.)

- **LNG IUDs** – The LNG IUDs are T-shaped devices that release LNG. There are four FDA-approved LNG IUDs available in the United States, which release a varying amount of LNG [11-14]. (See 'Levonorgestrel IUD' below.)

Multiple other IUD types and shapes have been used globally (picture 1).

Mechanism of action — Multiple mechanisms appear to contribute to the contraceptive action of IUDs (table 1) [15-19]. Pregnancy appears to be prevented by a foreign body effect induced by the IUD frame and by local changes caused by the released medication. When the uterus is exposed to a foreign body, a sterile inflammatory reaction occurs, which is toxic to sperm and ova and impairs implantation [17,19-22]. The production of cytotoxic peptides and activation of enzymes lead to inhibition of sperm motility, reduced sperm capacitation and survival, and sperm phagocytosis [23,24]. These cytotoxic effects are supported by studies in which fallopian tubes of IUD users were flushed but no sperm or fertilized ova were found [17,19]. Additional studies of IUD users were unable to find embryos or detect human chorionic gonadotropin, indicating that transient, or chemical, pregnancies were not occurring [21,25,26].

- **Copper IUD** – The addition of copper provides further contraceptive benefits. Copper enhances the cytotoxic inflammatory response within the endometrium; impairs sperm migration, viability, and acrosomal reaction; and impairs implantation [16,21,22,27,28].

- **LNG IUDs** – The addition of LNG provides further contraceptive benefits. Progestins thicken cervical mucus, which acts as a barrier to the upper genital tract, causing endometrial decidualization and glandular atrophy that impairs implantation and may inhibit the binding of the sperm and egg by increasing glycodelin A production [29-31].

Interruption of ovulation is not a major mechanism of IUDs. Copper IUDs have no impact on ovulation. For LNG IUDs, ovulation rates vary based upon the initial progestin dose and then increase as the progestin level falls over time. Most cycles are ovulatory. In clinical trials evaluating ovulation during the first year of IUD use, 45 percent of cycles were ovulatory for women using 52 mg LNG IUDs while 88 to 97 percent of cycles were ovulatory for lower-dose IUDs [11-14].

There is no evidence that IUDs disrupt an implanted pregnancy [32].

Benefits — There are multiple benefits of IUD use for women including:

- Highly effective pregnancy prevention (>99 percent) (figure 1).
- Does not require regular adherence from user to maintain high effectiveness.
- Long acting.
- Rapidly reversible.
- Few medical contraindications for most women, including teens and nulliparous women. (See "Intrauterine contraception: Candidates and device selection", section on 'Contraindications'.)
- Few side effects.
- Private and does not interfere with the spontaneity of sex.
- Avoidance of exogenous estrogen (both IUD types) and hormones (copper IUD only).
- Reduced costs with long-term use.
- Reduced risk of cervical, endometrial, and ovarian cancers.
    - **Cervical cancer** – A meta-analysis of 16 studies assessing the incidence of cervical cancer in IUD users reported that women with any history of IUD use were approximately 30 percent less likely to develop cervical cancer (summary odds ratio [OR] 0.64, 95% CI 0.53-0.77) [33]. The proposed mechanism is an altered immune response resulting from device insertion and presence [34,35]. This finding may be particularly relevant for women who have not received the human papillomavirus vaccine or who have limited access to cervical cancer screening.
    - **Endometrial cancer** – A Finnish study of over 90,000 women reported a 50 percent reduction in the risk of endometrial cancer (incidence ratio 0.50, 95% CI 0.35-0.70) and a 40 percent reduction in ovarian cancer (incidence ratio 0.60, 95% CI 0.45-0.76) among women who used at least one LNG IUD for abnormal uterine bleeding [36].

- **Ovarian cancer** – Another meta-analysis of 11 studies (9 case control, 2 cohort) reported a reduced rate of ovarian cancer with ever-use of an IUD (summary OR 0.68, 95% CI 0.62-0.75) [37]. The mechanisms by which an IUD might reduce cancer risk and the impact of device type on cancer risk are not known.

- Noncontraceptive benefits. (See 'Noncontraceptive benefits' below.)

Because of these factors, patient satisfaction and continuation rates are high [38-40]. Similarly, a 2015 United States study of over 9000 women ages 14 to 45 years using either the LNG or TCu380A IUDs reported one-, two-, three-, four-, and five-year IUD continuation rates of 88, 79, 70, 63 and 54 percent, respectively [40-42]. A Finnish study including almost 18,000 women using an LNG IUD reported continuation rates at one, two, three, four, and five years of 93, 87, 81, 75, and 65 percent, respectively [38]. For comparison, United States women using short-acting methods (ie, depot medroxyprogesterone acetate or hormonal contraceptive pills, patch, or ring) reported a 30 percent three-year contraceptive continuation rate.

Resumption of fertility after discontinuation is rapid and similar for IUDs [10-14], progestin-releasing implants [43,44], and contraceptive pills, rings, and patches [45,46].

Cost effectiveness — All IUDs are highly cost-effective; although the initial cost of the device and insertion can be high, the overall cost decreases with each year of use because no additional expenditure is required. At five years of use, the IUD is one of the most cost-effective methods of reversible contraception available [47]. A 2015 United States cost analysis study that compared the cost of long-acting and short-acting reversible contraceptives calculated that long-acting reversible contraception (including the copper and LNG 52 IUD) began saving money after 2.1 years of use when compared with short-acting reversible contraception that included pills, patch, ring, or injection [48].

COPPER IUD

Characteristics — The TCu380A contains a T-shaped polyethylene frame with 380 mm^2 of exposed surface consisting of fine copper wire wound around a vertical stem and copper collars on each of the horizontal arms [10]. A 3 mm ball at the base of the stem decreases the risk of cervical perforation (picture 2) [49]. A white or clear polyethylene monofilament string is knotted through this ball. The frame contains barium sulfate to make it radiopaque. The device is latex-free.

Clinically relevant allergy to copper is extremely rare [50]. Serum copper levels are higher in TCu380A users compared with nonusers and above the normal blood copper level range;

however, this increase in circulating copper does not have a negative clinical impact unless the patient has a contraindication or allergy to copper [51]. (See "Intrauterine contraception: Candidates and device selection", section on 'Contraindications'.)

An advantage of the TCu380A IUD as compared with the levonorgestrel (LNG) IUDs is that it can be used for emergency contraception (EC) when inserted within 120 hours (5 days) of unprotected intercourse [52]. When used as an EC method, the TCu380A has a <0.1 percent pregnancy rate [53]. The device can then be left in place to provide ongoing contraception [54]. (See "Emergency contraception", section on 'EC methods'.)

A disadvantage of the copper TCu380A is that it does not provide protection against upper genital tract infections. Compared with users of the LNG IUDs, copper IUD users have a greater risk of pelvic inflammatory disease (PID) if exposed to sexually transmitted infections (STIs) [55]. The difference in risk of PID is believed to be due to a progestin-mediated reduction in upper-tract infection in LNG IUD users rather than an increased risk in copper IUD users. However, dual method use with condoms provides excellent protection against transmission of STIs.

Efficacy — With perfect use, the probability of pregnancy in the first year is 0.6 percent; with typical use, the first-year pregnancy rate is 0.5 to 0.8 percent (table 2) [20,56,57]. Women under age 25 experience a slightly higher failure rate, most likely because they are more fertile than older women. These failure rates are comparable to surgical sterilization [58].

While failure rates for both IUDs are low overall (figure 1), the rates of failure with the copper IUD may be somewhat higher than with progestin-releasing IUDs, although conflicting data exist [57,59]. In one study of over 58,000 women, the copper IUD first-year failure rate was 0.52 versus 0.06 pregnancies per 100 woman-years for the LNG 52 IUD [57]. In addition, the ectopic pregnancy rate was higher for copper IUDs than the LNG 52 IUD (0.08 versus 0.02 ectopic pregnancies per 100 woman-years). While the proportion of ectopic pregnancies was higher for women with LNG IUDs compared with copper IUDs (27 versus 15 percent), the overall incidence rate of ectopic pregnancy was higher for copper IUD users because of the somewhat higher overall failure rate. Of note, the copper IUD study group contained more than 30 types of copper IUDs, which may have impacted the results. As an example, IUDs with less than 380 mm^2 of copper and inert IUDs are less effective than those containing ≥380 mm^2 of copper [60,61].

Duration of use — The TCu380A is approved by the US Food and Drug Administration to remain in place for 10 years; this may vary elsewhere. However, some clinicians use the TCu380A for more than 10 years before exchanging it for a new IUD. The use of the TCu380A beyond 10 years is supported by several studies [62-64]. In two studies of 314 women who used the TCu380A for an additional two years (10 to 12 years from insertion), no pregnancies were reported [62,63]. Additionally, no pregnancies were reported in the subgroup of eight women who used the device

for up to 16 years [63].

We counsel patients about the advantages of extended use of the TCu380A (cost savings, prolongation of contraception, and avoidance of an additional intrauterine procedure). However, for patients with strong preferences for following the package insert recommendation to remove the TCu380A at 10 years, we remove and replace as desired or indicated.

In addition to patient preference, extended use depends on patient age at insertion because age impacts fertility.

- For women younger than 25 years at the time of TCu380A IUD placement, we recommend replacing the IUD after 10 years of use because younger women are more fertile.
- For women age 25 to 34 years at the time of TCu380A IUD placement, the IUD may be left in place for up to 12 years [62,63].
- For women age 35 years or older at the time of TCu380A IUD placement, we recommend leaving the IUD in place until menopause if the patient is happy with the method and still requires contraception [65].

Noncontraceptive benefits — Noncontraceptive benefits of the copper IUDs include continued menstrual cyclicity, reduced risk of cervical cancer, and possibly a reduction in endometrial cancer [33,66-68].

LEVONORGESTREL IUD

Devices and characteristics — The levonorgestrel (LNG)-releasing IUDs are available in three different formulations in the United States:

- **A 52 mg LNG IUD** – This IUD has an initial LNG release rate of approximately 20 mcg/day, which declines to an average release of 10 mcg/day at five years [14]. These devices are approved by the US Food and Drug Administration (FDA) for six years (abbreviated LNG 52, commercial names Mirena and Liletta) [11,14,69].
- **A 19.5 mg LNG IUD** – The initial LNG release rate is 17.5 mcg/day, which declines to 7.4 mcg/day at five years and is FDA approved for five years of use (abbreviated LNG 19.5, commercial name Kyleena) [12].
- **A 13.5 mg LNG IUD** – The initial LNG release rate is approximately 14 mcg/day, which declines to 5 mcg/day at three years and is FDA approved for three years of use (abbreviated LNG 13.5, commercial name Skyla) [13].

Both 52 mg IUDs (picture 3) consist of a T-shaped polyethylene frame measuring 32 by 32 mm, with a collar containing 52 mg of LNG dispersed in polydimethylsiloxane attached to a vertical stem [14]. A string is attached to the distal end of the stem. The insertion tube diameter for the 52 mg LNG IUDs ranges from 4.4 to 4.8 mm [11,14]. Both devices contain barium in the frame to make them detectable by radiograph.

Like the 52 mg IUDs, the LNG 19.5 and the LNG 13.5 also use the T-shaped design. In contrast, the LNG 19.5 and LNG 13.5 have a smaller frame (28 by 30 mm versus 32 by 32 mm) and are smaller in diameter (3.8 mm inserter versus 4.4 mm) [11-14]. The smaller diameter may allow easier insertion for women with very small uterine cavities or cervical stenosis, but there are no comparative trials. The LNG 19.5 and LNG 13.5 contain a silver ring at the top of the stem to distinguish them on ultrasound and barium in the frame to make them detectable by radiograph [12,13].

The progestin effect of hormone-releasing IUDs is primarily at the level of the endometrium [70]. As an example, the endometrial concentration of LNG is 1000 times higher with the LNG-releasing IUDs compared with the LNG subdermal implant [71]. However, the high endometrial concentration from the IUDs does not result in a high plasma concentration; the absolute plasma LNG levels are much lower. For the 13.5 mg, 19.5 mg, and 52 mg LNG IUDs, the plasma LNG concentration is highest seven days postinsertion with levels between 100 and 250 pg/mL. There is a gradual decline over time with wide individual variation [11-14,72-74]. This level is half that seen with progestin implants (350 pg/mL) and much less than that associated with progestin-only pills (1500 to 2000 pg/mL) [75,76] but high enough to cause systemic side effects in some users. Serum estradiol levels are not affected [73].

In contrast to the TCu380A, there are limited published data on the use of the LNG 52 IUD for emergency contraception (EC), although studies are ongoing [52]. There is a single study of women receiving a LNG 52 IUD concomitantly with 1.5 mg of oral LNG for EC, which found the probability of pregnancy was 0.9 percent (95% CI 0.0-5.1 percent) two weeks postinsertion [77]. (See "Emergency contraception", section on 'EC methods'.)

Efficacy — With perfect use of the LNG 52, the probability of pregnancy in the first year is 0.1 percent; with typical use, the first-year pregnancy rate is 0.1 to 0.2 percent (table 2) [57,78,79]. With five years of continuous LNG 52 use, the cumulative pregnancy rate is 0.7 percent [11,80,81]. The clinical trial for the LNG 52 reported cumulative pregnancy rates of 0.14 percent at one year and 0.87 percent at four years [82]. In a phase three trial of the LNG 19.5 and LNG 13.5 devices, the cumulative pregnancy rates were 0.2 and 0.4 percent at one year and 0.9 and 1.0 percent at three years, respectively [83]. These rates are comparable to those of sterilization procedures (figure 1) [58].

While the overall risk of pregnancy is low with LNG IUDs, if a pregnancy is conceived, ectopic pregnancy is more common in women using LNG IUDs compared with copper IUDs. In a study of over 61,000 European women with a newly inserted IUD, the proportion of ectopic pregnancies was higher in LNG users compared with copper IUD users (27 versus 15 percent) [57]. However, as discussed above, the overall incidence risk of ectopic pregnancy was lower with LNG IUDs because of the lower absolute risk of pregnancy. Thus, women who conceive while using a LNG IUD should be evaluated for ectopic pregnancy. (See 'Efficacy' above.)

Duration — Both LNG 52 IUDs are approved for up to six years of use by the FDA (commercial names Mirena and Liletta) [11,14]. After five years of use, the LNG 52 releases approximately double the amount of LNG as the LNG 13.5 IUD releases after three years, which suggested that the LNG 52 IUD could be used beyond five years [84]. Direct evidence also supports use of the LNG 52 IUDs to six years [64,85,86]. In a prospective cohort study of nearly 500 women with extended use of the LNG 52 IUDs, two pregnancies were reported during the two-year extended observation, for six- and seven-year cumulative failure rates of 0.25 and 0.43 per 100 woman-years [85]. A different chart review of 766 women who used the LNG 52 beyond five years reported no pregnancies after a mean of 73 months of use (range 61 to 184 months) [86].

Based on available data, neither of the LNG 52 IUDs should be used for more than seven years [65]. The LNG 19.5 and 13.5 have a lower LNG dose, and there is no evidence supporting extended use of these IUDs past the FDA-approved duration [65].

Noncontraceptive benefits — Noncontraceptive benefits of 52 mg LNG IUDs include reduction in heavy menstrual bleeding, anemia, dysmenorrhea, endometriosis-related pain, endometrial hyperplasia, pelvic inflammatory disease, and cervical cancer [33,87-93]. The use of the LNG 52 IUD for treatment of heavy menstrual bleeding is FDA approved [11]. LNG use of 52 mg LNG IUDs for these other noncontraceptive indications is off-label but a common practice that is supported by strong medical evidence. For obese individuals with complex atypical hyperplasia, several observational studies have reported improved resolution with LNG IUD treatment compared with systemic progestin therapy [94,95]. There is also a reduction in the risk of endometrial cancer and ovarian cancer with LNG IUDs. The use of the IUD or surgical procedures to treat heavy menstrual bleeding is reviewed in detail elsewhere. (See "Abnormal uterine bleeding: Management in premenopausal patients", section on 'Levonorgestrel intrauterine device versus surgical treatments'.)

There is minimal information on the noncontraceptive benefits of the LNG 19.5 and 13.5 IUDs.

IMPACT OF DEVICE TYPE ON BLEEDING PATTERN

Both types of IUDs are associated with alterations in bleeding patterns, although the changes differ. In general, copper IUDs are associated with heavier menstrual bleeding while levonorgestrel (LNG) IUDs can cause lighter bleeding, amenorrhea, or minimal change, depending on the LNG dose.

Copper IUD — Women considering the copper IUD are counseled that menses may be heavier, longer, or more painful, particularly in the first several cycles after insertion. In a study of over 3800 women using either the TCu380A or the LNG 52, at three months the copper IUD users had more cramping (63 versus 32 percent), increased bleeding volume (71 versus 12 percent), and increased bleeding frequency (41 versus 33 percent) than LNG 52 users [96]. These symptoms improved rapidly, and at six months the copper IUD users reported symptom reduction to levels similar to the LNG 52 users (cramping 14 versus 12 percent, increased bleeding volume 19 versus 8 percent, increased bleeding frequency 13 versus 11 percent). The amount of baseline menstrual bleeding a woman has prior to copper IUD insertion does not appear to impact the 12-month device continuation rate; women with baseline heavy menstrual bleeding are not more likely than those without to remove the device [97]. Nonsteroidal anti-inflammatory drugs (NSAIDs) appear to decrease menstrual blood loss and bleeding duration, particularly in women with heavy or prolonged bleeding [98]. (See "Intrauterine contraception: Management of side effects and complications", section on 'Post-insertion bleeding' and "Intrauterine contraception: Management of side effects and complications", section on 'Irregular bleeding and/or cramping'.)

While the average monthly menstrual blood loss may increase by up to 55 percent throughout the duration of copper IUD use, it rarely leads to anemia for most women. A systematic review reported the hemoglobin concentration decreased by 0.36 to 0.94 g/dL over 12 months in copper IUD users who were not anemic at baseline [99].

Levonorgestrel-releasing IUDs — For the LNG-releasing IUDs, the most common changes in bleeding patterns include prolonged bleeding (59 percent), unscheduled bleeding (up to 52 percent), amenorrhea (6 to 20 percent), and spotting (23 to 31 percent) at the end of one year of use [11-13,82,100]. Women should be reassured that the changes in bleeding patterns are a side effect of the hormone on the uterine lining and are not dangerous. All women should be counseled that intermenstrual bleeding is common, especially with the onset of use, and improves by six months of use [11,13,82,96]. In a study including 3001 LNG 52 users who were surveyed at three and six months of IUD use, reductions were reported in the frequency of bleeding (33 to 11 percent) and in heavier bleeding volume (12 to 8 percent) at the six-month assessment point [96]. The management of these and other hormonal side effects, such as breast tenderness, mood changes, and acne, is discussed in detail separately. (See "Intrauterine contraception: Management of side effects and complications".)

While changes in bleeding patterns are common with the 52 mg, 19.5 mg, and 13.5 mg LNG IUDs, the amenorrhea rate differs substantially among the devices. After one year of use, amenorrhea is reported by approximately 20 percent of 52 mg LNG IUD users, 12 percent of LNG 19.5 users, and 6 percent of LNG 13.5 users [11-13,82,100,101]. At the end of three years of use, 30 to 50 percent of 52 mg LNG users reported amenorrhea compared with 20 and 12 percent of women using the LNG 19.5 and LNG 13.5, respectively [11-13,82]. Therefore, women who prefer to avoid menstrual bleeding may benefit from a 52 mg device, and women who prefer the reassurance of monthly menstruation may benefit from the 19.5 or 13.5 mg device. Both groups must be counseled that the desired menstrual change may not occur; some women with the 52 mg devices will continue to have monthly periods, and some with the lower dose devices will become amenorrheic.

Bleeding-related discontinuation rates — With supportive counseling, most women are able to tolerate the changes in bleeding patterns, and discontinuation rates are low overall for all devices. In a study of over 3800 women using either the TCu380A or the LNG 52, the overall satisfaction rate for the copper IUD was greater than 90 percent, and the device discontinuation rate was approximately 6 percent at six months of use [96]. In the six-year LNG 52 clinical trial, 2.3 percent of women discontinued the device early because of bleeding complaints compared with a 12 percent overall early discontinuation rate [82]. Similarly, in the three-year LNG 13.5 clinical trial, the early discontinuation rates were 4.6 percent for bleeding complaints and 18 percent overall [13]. For comparison, other reasons for discontinuation of the LNG 13.5 IUD included device expulsion (3.2 percent), acne/seborrhea (2.9 percent), abdominal pain (2.5 percent), dysmenorrhea/uterine spasms (2.0 percent), and pelvic pain (1.8 percent). (See "Intrauterine contraception: Management of side effects and complications", section on 'Irregular bleeding and/or cramping' and "Intrauterine contraception: Management of side effects and complications", section on 'Continued bleeding and cramping'.)

RISK OF EXPULSION

The incidence of expulsion is 3 to 10 percent for the TCu380 and 3 to 6 percent for the levonorgestrel IUD in the first year of use [20,56,62,102,103]. The symptoms and risk factors of expulsion are discussed separately. (See "Intrauterine contraception: Management of side effects and complications", section on 'Expulsion' and "Contraception: Postabortion", section on 'Intrauterine device' and "Postpartum contraception: Counseling and methods", section on 'Intrauterine devices'.)

OTHER IUD TYPES

Inert IUDs — Unmedicated IUDs are approved for use outside the United States and are popular because they can remain in place for 20 years or more. The devices are composed of inert materials such as plastic or stainless steel. The Lippes Loop, a polyethylene IUD containing barium sulfate with a single filament tail, is used globally. Flexible stainless steel rings visible on radiographs, but with no string, were widely used in China [104]. The pregnancy rates for the Lippes Loop vary by device size and range from 1 to 4.8 per 100 women-years [105,106]. The higher failure rate of the stainless steel ring compared with copper T IUDs (10.6 versus 1.7 percent) led the Chinese State Family Planning Commission to stop production of the ring in 1993 and to encourage the use of copper or levonorgestrel (LNG)-releasing IUDs instead [20,104,107].

As medicated IUDs are more effective, we recommend replacing inert IUDs with LNG-releasing or copper IUDs, especially for women below age 40, as they have higher fertility rates. We also inform women ages 40 and older that LNG and copper IUDs are more effective than inert IUDs but do not encourage switching if the patient is happy with her device.

Frameless IUDs — Frameless IUDs, which are available outside of the United States, contain either copper or LNG that has been attached to a nonresorbable filament. The GyneFix 330 is made up of copper cylinders threaded onto a polypropylene suture instead of the plastic frame common to other IUDs [108,109]. The FibroPlant is a frameless LNG-releasing IUD consisting of a nonresorbable thread attached to a fibrous delivery system that releases 14 or 20 mcg of LNG per day [110]. These devices are anchored to the endometrium using an insertion technique that requires additional training as the technique is different from the other types of IUDs. The intrauterine ball SCu300A is comprised of copper beads strung on a memory alloy wire that curls into a ball shape on insertion into the uterus [111].

Advantages of these systems include small size, high efficacy, and high tolerability. They are as effective as conventional IUDs and may be more adaptable to variations in the shape of the uterine cavity [112,113].

SOCIETY GUIDELINE LINKS

Links to society and government-sponsored guidelines from selected countries and regions around the world are provided separately. (See "Society guideline links: Contraception".)

INFORMATION FOR PATIENTS

UpToDate offers two types of patient education materials, "The Basics" and "Beyond the Basics." The Basics patient education pieces are written in plain language, at the 5th to 6th grade reading

level, and they answer the four or five key questions a patient might have about a given condition. These articles are best for patients who want a general overview and who prefer short, easy-to-read materials. Beyond the Basics patient education pieces are longer, more sophisticated, and more detailed. These articles are written at the 10th to 12th grade reading level and are best for patients who want in-depth information and are comfortable with some medical jargon.

Here are the patient education articles that are relevant to this topic. We encourage you to print or e-mail these topics to your patients. (You can also locate patient education articles on a variety of subjects by searching on "patient info" and the keyword(s) of interest.)

- Basics topics (see "Patient education: Intrauterine devices (IUD) (The Basics)" and "Patient education: Long-acting methods of birth control (The Basics)")
- Beyond the Basics topic (see "Patient education: Long-acting methods of birth control (Beyond the Basics)")

SUMMARY AND RECOMMENDATIONS

- The intrauterine device (IUD) is the most commonly used method of reversible contraception worldwide and is used by an average of 23 percent of female contraceptive users globally. Two types of IUDs are available in the United States, copper-containing and levonorgestrel-releasing (LNG) devices. The LNG-releasing devices are available in multiple formulations. (See 'Prevalence of use' above and 'Types of IUDs' above.)
- Multiple mechanisms appear to contribute to the contraceptive action of IUDs (table 1). Pregnancy appears to be prevented by a foreign body effect induced by the IUD frame and by local changes caused by the released medication. (See 'Mechanism of action' above.)
- There are multiple benefits to IUD use, including that IUDs are one of the most effective methods of contraception (figure 1), which result in high user satisfaction rates. The IUD is also cost-effective when used over multiple years. (See 'Benefits' above and 'Cost effectiveness' above.)
- The TCu380A contains a T-shaped polyethylene frame with 380 mm^2 of exposed surface consisting of fine copper wire wound around a vertical stem and copper collars on each of the horizontal arms; a 3 mm ball at the base of the stem decreases the risk of cervical perforation (picture 2). The TCu380A can also be used for emergency contraception and left in place for continued contraception. (See 'Characteristics' above.)
    - With perfect use, the probability of pregnancy in the first year is 0.6 percent; with typical

use, the first year pregnancy rate is 0.5 to 0.8 percent (table 2). While failure rates for both copper and LNG-releasing IUDs are low overall, the rates of failure with the copper IUD are somewhat higher than with progestin-releasing IUDs. (See 'Efficacy' above.)

- In the United States, the TCu380A is approved by the US Food and Drug Administration (FDA) to remain in place for 10 years. However, this may vary elsewhere since the use of the TCu380A beyond 10 years is supported by several studies. (See 'Duration of use' above.)

- Women considering the copper IUD are counseled that menses may be heavier, longer, or more painful, particularly in the first several cycles after insertion. These changes in menstrual symptoms generally do not cause women to remove the IUD and rarely lead to anemia. (See 'Copper IUD' above.)

- There are four types of LNG-releasing IUDs available in the United States, with progestin-release rates ranging from 14 to 20 mcg/day (picture 3). The progestin effect of hormone-releasing IUDs is primarily at the level of the endometrium. (See 'Devices and characteristics' above.)

  - With perfect use of the LNG 52 IUDs, the probability of pregnancy in the first year is 0.1 percent; with typical use, the first-year pregnancy rate is 0.1 to 0.2 percent (table 2). (See 'Efficacy' above.)

  - The duration of use varies with the type of LNG IUD. The LNG 52 devices are approved for up to six years of use by the FDA. The LNG 19.5 and 13.5 have a lower LNG dose, and there is no evidence supporting extended use of these IUDs. (See 'Duration' above.)

  - Noncontraceptive benefits of 52 mg LNG IUDs include reduction in heavy menstrual bleeding, anemia, dysmenorrhea, endometriosis-related pain, endometrial hyperplasia, pelvic inflammatory disease, and cervical cancer. (See 'Noncontraceptive benefits' above.)

- Inert, or unmedicated, IUDs are approved for use outside the United States and are popular because they can remain in place for 20 years or more. The devices are composed of inert materials such as plastic or stainless steel. (See 'Inert IUDs' above.)

- Frameless IUDs, which are available outside of the United States, contain either copper or LNG that has been attached to a nonresorbable filament. Advantages of these systems include small size, high efficacy, and high tolerability. They are as effective as conventional IUDs and may be more adaptable to variations in the shape of the uterine cavity. (See 'Frameless IUDs' above.)

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Topic 116579 Version 24.0

GRAPHICS

IUDs from around the world

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Graphic 61717 Version 1.0

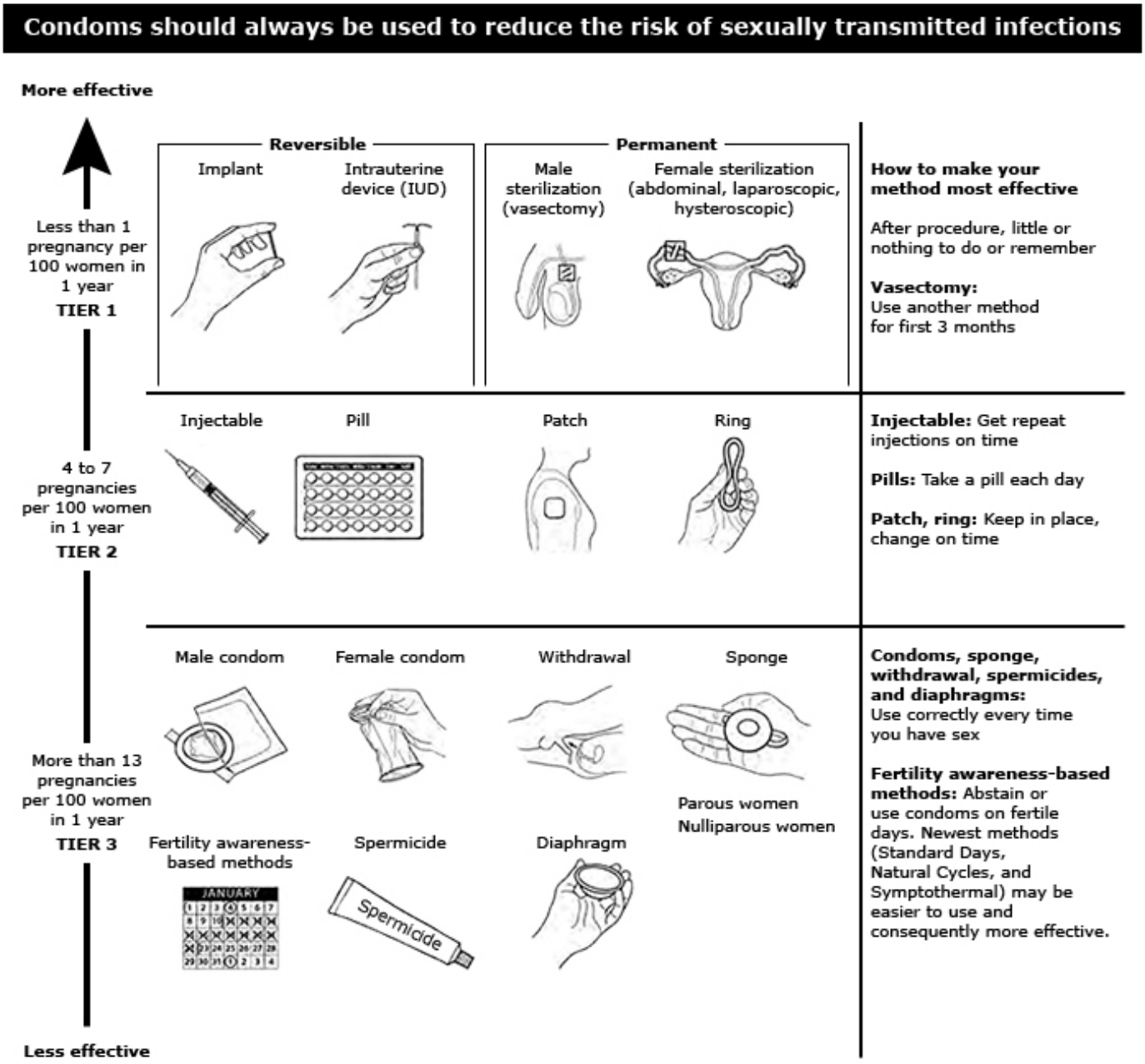
Possible mechanisms of action of intrauterine devices

Changes in cervical mucus that inhibit sperm transport (eg, increased copper concentration, thickening, glandular atrophy or decidualization)
Chronic inflammatory changes of the endometrium and fallopian tubes, which have spermicidal effects and inhibit fertilization and implantation
Thinning and glandular atrophy of the endometrium, which inhibits implantation
Direct ovicidal effects

Data from: Stanford JB, Mikolajczyk RT. Am J Obstet Gynecol 2002; 187:1699.

Graphic 61064 Version 2.0

Comparison of effectiveness of contraceptive methods



Other methods of contraception:

- Lactational amenorrhea method – LAM is a highly effective, **temporary** method of contraception
- Emergency contraception – Emergency contraceptive pills or a copper IUD after unprotected intercourse substantially reduces risk of pregnancy

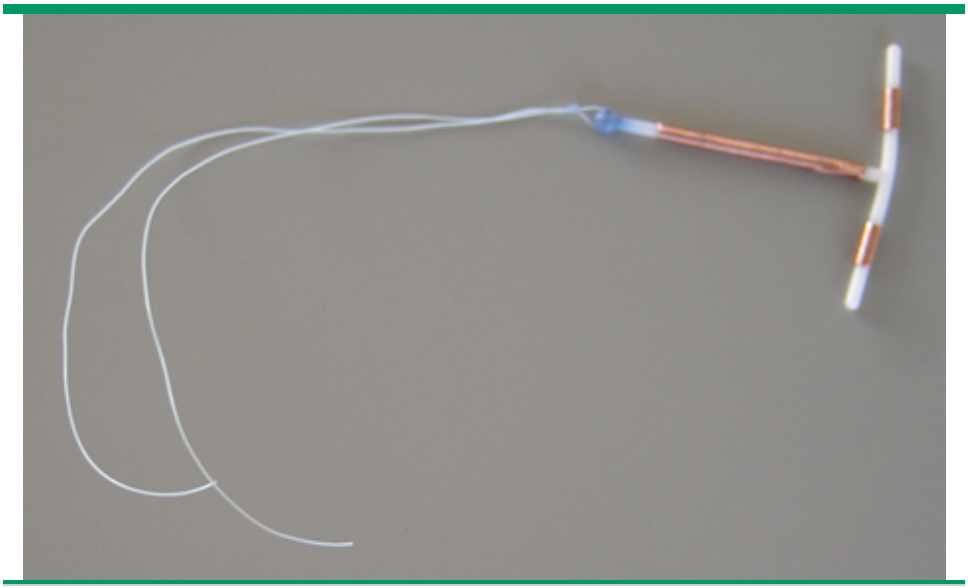
LNG: levonorgestrel.

Adapted from: U.S. Selected Practice Recommendations for Contraceptive Use, 2013: Adapted from the World Health Organization Selected Practice Recommendations for Contraceptive Use, 2nd Edition. MMWR Morb Mortal Wkly Rep 2013; 62:1.
Additional information from:

1. *Trussell J, Aiken ARA, Mickes E, Guthrie K. Efficacy, Safety, and Personal Considerations. In: Contraceptive Technology, 21st ed, Hatcher RA, Nelson AL, Trussell J, et al (Eds), Ayer Company Publishers, Inc., New York 2018.*

Graphic 57795 Version 9.0

TCu380A (ParaGard) intrauterine contraceptive device



This device consists of a T-shaped polyethylene frame with 380 mm^2 of exposed surface consisting of fine copper wire wound around the vertical stem and each of the horizontal arms. There is a 3 mm ball at the base of the stem to decrease the risk of cervical perforation. A white or clear polyethylene monofilament string is knotted through this ball.

Graphic 56136 Version 3.0

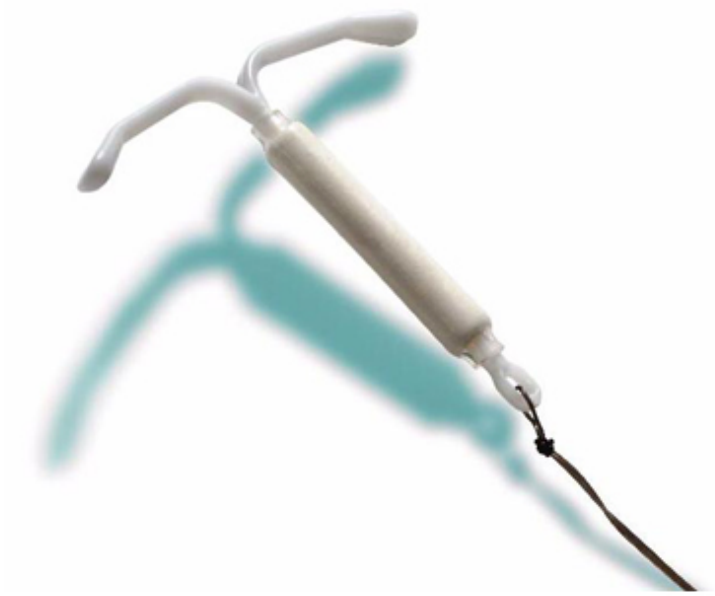
Comparison of intrauterine devices

	Type		
	TCu380A IUD	**Levonorgestrel IUD (52 mg)**	**Levonorgestrel IUD (13.5 mg)**
Duration of therapeutic effect (years)	12	7	3
First year of use pregnancy rate, perfect use (percent)	0.6	0.1	0.4
First year of use pregnancy rate, typical use (percent)	0.5 to 0.8	0.1 to 0.2	
5-year cumulative pregnancy rate (percent)	1.4±0.4	1.1±0.5	0.9*
10-year cumulative pregnancy rate (percent)	2.2		
FDA-approved duration of use (years)	10	5	3

IUD: intrauterine device; FDA: US Food and Drug Administration.
* Skyla is approved for 3 years of use. The 3-year cumulative pregnancy rate is 0.9 percent.

Graphic 80860 Version 8.0

Mirena IUD



Graphic 81587 Version 2.0

Contributor Disclosures

Tessa Madden, MD, MPH Consultant/Advisory Boards: Bayer [Data safety monitoring board]. **Courtney A Schreiber, MD, MPH** Patent holder: Penn, Saul [Medical management of nonviable pregnancy]. Grant/Research/Clinical Trial Support: Bayer [Contraception]; Medicines360 [Contraception]; VeraCept [Contraception]. Consultant/Advisory Boards: Danco Pharmaceuticals [Early pregnancy loss]; Medicines360 [Consultant]. Other Financial Interest: American Board of Obstetrics and Gynecology. **Kristen Eckler, MD, FACOG** Nothing to disclose

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Conflict of interest policy

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