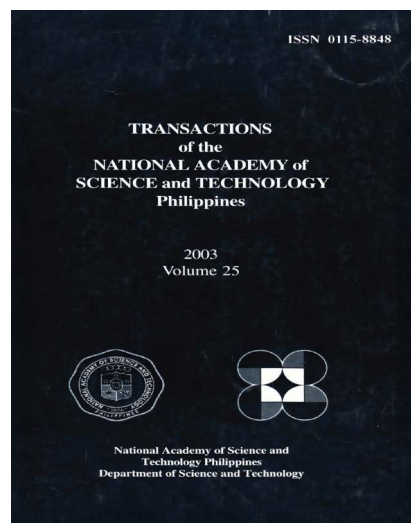


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# Mechanical, Chemical, and Surgical Methods of Contraception

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## **MECHANICAL, CHEMICAL AND SURGICAL METHODS OF CONTRACEPTION**

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### **Abstract**

This paper discusses mechanical, chemical, surgical methods of contraception and the intrauterine contraceptive devices. Mechanical methods include condom for men and women and diaphragm or cap. Chemical methods consist of application of chemical preparations which are spermicidal. Surgical methods are sterilization procedures. Female sterilization is done by one of several methods such as laparotomy, mini-laparotomy, laparoscopy, culdotomy, culdoscopy and hysteroscopy. Male sterilization or vasectomy involves cutting and tying of the vas deferens. Different types of IUDs are described. The paper further discusses the mechanism of action, advantages and disadvantages of the different contraception methods or device.

**Key words:** contraception, mechanical, chemical, surgical, intrauterine devices

### **Introduction**

Methods of contraception may be classified as natural or artificial, temporary or permanent. The natural and temporary methods are the cervical mucus, calendar rhythm, basal body temperature (BBT), sympto-thermal and the lactational amenorrhea (LAM). All these are considered periodic abstinence except the Lactational Amenorrhea Method (LAM). The artificial and temporary methods are the Barriers – both mechanical (condom and diaphragm) and chemical (spermicides); hormonal (pills, injectables and implants) and the intrauterine contraceptive devices (IUCD). The permanent methods are surgical steriliza-

tion procedures such as bilateral tubal ligation for women and vasectomy for men.

This paper will be limited to the discussion on the mechanical, chemical and surgical methods of contraception, and the intrauterine contraceptive devices.

### **Mechanical Methods**

There are two main types of mechanical barriers: the condom and diaphragm or cap. Condoms are available for both men and women. The diaphragm is used by the female for the vagina and cervix. The cap is smaller than the diaphragm and is used to cover the cervix. All these methods prevent the meeting of the egg and the sperms.

#### **Condom for Men**

The condom is a rubber or plastic sheath used to cover the whole length of the erect penis. Ejaculation is thus made inside the device and the semen is usually collected in a receptacle at the tip.

When it is used properly, the condom is more than 97% effective. Couples using the condom, however, report lower levels of effectiveness because they do not use it properly and consistently. Pregnancy rates have been as high as 26% per 100 couple - years of use in a study in the Philippines (Laing and Alcantara, 1977). In the United States study, 14% of married women have an accidental pregnancy during the first year of condom use (Grady et al, 1986). Condoms are also protective against sexually transmitted diseases including HIV/AIDS and Hepatitis B. The main objections to its use are it reduces sensation, interrupts sex and embarrasses the couple. Condoms may come in different materials, textures, sizes, colors and shapes. They are sometimes called rubber, sheath, skin and prophylactics.

#### **Condom for Women**

This is a fairly new barrier contraceptive device for women. It is available in some places. This device is inserted into the vagina and made of medical-grade polyurethane. It consists of soft loose fitting polyurethane sac about 15 cm long and 7 cm in diameter. Attached at its open end is a flexible outer polyurethane ring, which covers the vulva, with its present version, a flexible inner ring to aid insertion and retention. Sexual intercourse takes place, with a good lubricant (usually spermicides) within the cavity of the device. It is marketed as Femshield, Reality and etc.

The effectiveness of the method is around 95%. If not properly and consistently used, the pregnancy rate may be around 24%. The advantages and disad-

vantages of this are similar to those of the male condom.

### **Diaphragm or Cap**

This is made of a round metal spring with a soft rubber dome. This rubber dome is applied against the cervix, covering and setting it apart from the seminal pool.

The physician determines the appropriate size of the diaphragm or cap for each patient. He also gives detailed instructions regarding insertion and removal.

Spemicidal agents are used also as lubricants, applied against the inner surface of the diaphragm to increase its effectivity. When properly used they can be 96% effective, but when not used consistently they can give as much as 20% pregnancy rate.

The diaphragm must be inserted not more than one hour before intercourse, and should not be removed until at least eight hours afterwards. After removal, further precaution is taken by applying additional spermicides in the vagina or by taking a douche.

The diaphragm has not gained much popularity in the Philippines because women find insertion and removal quite cumbersome. In many instances, it is not easy to check whether it is properly applied. It may also be dislodged during sexual intercourse. And the distracting thought of a misplaced, non-protecting diaphragm somehow diminishes full enjoyment of the sex act. Because of the reasons mentioned it is not popular and is not commercially available in our country.

The only advantage one can say about the use of the device is – the woman has full control of the situation.

### **Chemical Methods**

Many chemical preparations are available in the form of foaming tablet, cream, foam, jelly, melting film and sponge that are used as contraceptive methods. Some of the chemical components present in them are nonoxynol-9, memfegol, polyoxythene (10) and nonyphenylether (NP 10). These are lethal to the sperms, preventing the meeting of the egg and the sperms.

When applied deep in the vagina, they dissolve in about ten minutes, acting like a protective cover over the external surface or plug in opening of the cervix, coital movements hasten the spread.

When used properly, they are 94% effective. When not used correctly or consistently, they can give as high as 26% failure rate or pregnancy rate. The advantages of this method are the following — good control of the situation, useful for emergency cases and may also prevent STD. The disadvantages are they can irritate, give allergic reaction and that may also be noisy or messy.

### Surgical Methods

Surgical methods for contraception are also called sterilization, procedures which render the man or the woman permanently infertile. Sterilization operations for either sex are based on the same standard approach of cutting or occluding the tubes that carry the sex cells towards junction and contraception.

#### Female Sterilization

Sterilization in the female consists mainly of cutting or blocking the fallopian tubes, and may be done by using one of the several methods: laparotomy, mini-laparotomy, laparoscopy, culdotomy, culdoscopy and hysteroscopy.

**Laparotomy.** Tubal ligation may be done in the course of a laparotomy either for a Cesarean Section or some other gynecologic (and in certain instances non-gynecological) operation. With the pelvic organs exposed, the surgeon reaches for the fallopian tubes, selects the appropriate segment and performs the procedure with the usual clamp-cut-tie technique.

It is not advisable to do a laparotomy for the exclusive purpose of doing tubal ligation because of its risk, inconvenience, and expense.

**Mini-Laparotomy.** Commonly shortened to "mini-lap," this operation consists of a very small incision, through which tubal ligation may be performed. This may be done (1) post-partal or just after delivery, (2) post-abortal or just after an abortion, and (3) an interval or in a non-pregnant uterus.

In post-partum cases, usually within 12 hours, when the fundus of the uterus is still high, a small incision is made at the infra-umbilical region. This is carried down to the peritoneum and, through this opening, the two fallopian tubes can be exposed, hooked and ligated. This operation will not lengthen the hospital stay of the patient, nor will it add to the discomfort of the delivery.

In cases of small uteri as in post-abortal or interval cases, the small incision is usually made a few centimeters above the symphysis pubis. The uterus, with the help of a "uterine elevator," which is inserted through the cervical canal, is raised and pushed against the anterior abdominal wall. The bulge thus made by the uterus guides the surgeon as to where the incision will be made. The incision is also carried down to the peritoneum and the fallopian tubes are ligated through this opening.

Minilaparotomy can be done on an out-patient basis.

**Culdotomy.** For those who do not want to have a scar on the abdomen, culdotomy (sometimes called colpotomy) may be done. The fallopian tubes are reached and ligated through a small incision at the posterior fornix of the vagina which corresponds with the posterior cul-de-sac. This operation may be done under local infiltration, low spinal, or even general anesthesia; depending on the preference of the surgeon or the patient.

Since the operation is in the vagina, sexual relations are not allowed until after one month.

**Laparoscopy.** The method involves visualization of the pelvic organs, through a puncture in the anterior abdominal wall with the use of an instrument called laparoscope. This instrument has connections for carrying out minor surgical procedures like tubal occlusion by electrocautery or application of silastic clips (Hulka or Filshie) or rings (Falope, Yoon, Felshie).

Basically, the procedure consists of the following features: (1) creation of pneumoperitoneum, (2) insertion of the scope and exploration of the pelvic organs, and (3) tubal occlusion. This procedure has been highly simplified with the introduction of safe and short-acting anesthesia. This can be done under local infiltration of Xyclocaïne, with the help of sedatives or tranquilizers such as Valium and Demerol. With this, the patient can be operated on and can stay in the hospital recovery room for only three to four hours. This procedure can also be done under general anesthesia or regional anesthesia (e.g. spinal) depending on the choice of the surgeon and/or patient.

Laparoscopy has gained popularity in the Philippines because (1) it has been proven to be effective, (2) it is relatively safe, (3) it is inexpensive, (4) efforts are being exerted to make it easily available, and (5) the various media have been helping a lot in advertising this to the masses.

Among the possible though rare complications are: (1) intra-peritoneal bleeding, (2) perforation of the viscera, (3) hematoma of the abdominal wall, (4) electric shock, (5) burns, and (6) adverse effect due to anesthesia. These, of course, are minimized by the expertise of the surgeons.

Like any other procedure, laparoscopy has certain contraindications, some of which are severe cardio-pulmonary disease, previous abdominal operations, peritonitis and obesity.

**Culdoscopy.** Like laparoscopy, culdoscopy is visualization of the pelvic organs through a scope called a culdoscope. The difference is that the instrument is inserted through the posterior fornix of the vagina and into the cul-de-sac. The uterus, the ovaries and the fallopian tubes can thus be seen. To do the tubal ligation an additional forceps is inserted through the same incision and the fallopian tubes are brought out where a fimbriectomy or application of silastic clip or insertion of silastic ring can be done.

The patient during this operation is in the knee-chest position.

Complications to be guarded against are bleeding, perforation of the bowels, and infection. Contraindications include the presence of infection in the vagina or cervix of the uterus, inability of the patient to assume a knee-chest position and atresia of the vagina.

This can be an out-patient procedure like the laparoscopic tubal ligation.

**Hysteroscopy.** In hysteroscopy, the approach is through the cervical canal into the uterine cavity. The uterine ostia of the fallopian tubes are visualized, then cauterized or inserted with plugs. This method is not popular in the

Philippines and has been tried only in isolated cases. However, it does hold promise and perhaps in the future will be part of routine sterilization armamentum.

### **Male Sterilization**

**Vasectomy.** Male sterilization, or vasectomy, is a simple procedure that involves the cutting and tying of the vas deferens – the two tube like passages that stem from the testis. The sperms produced in the testes moves upward via the vas deferens to the seminal vesicle where they mix with the semen, then come out through penis during ejaculation.

Vasectomy is a ten – to fifteen-minute operation, after which the patient goes home. The doctor simply makes cut or opening of less than half an inch on both sides of the scrotum or sac that holds the testis. Some doctors prefer to do one midline opening of the scrotum. From these openings, the vas deferens is exposed, cut and tied. After the procedure, the doctor sutures up the openings of the sac. An innovation in vasectomy is what we call No scalpel. The vas deferens is exposed not through an incision but with used of special forceps.

Vasectomy is not immediate sterilization. After the operation the patient is still capable of impregnating a woman because sperms are still present in the cut portion of the vas deferens, in the seminal vesicle and in the penis. It would normally take fifteen ejaculation to empty these areas of the remaining sperm. The patient is advised to come back for a sperm count; he is sterile or no longer capable of fathering a child when he has arrived at zero sperm count after vasectomy.

Vasectomy is often confused with castration, or removal of the testicles. Other unfounded fears regarding this minor operation are that it causes impotence or inability to have an erection, pre-mature ejaculation, and the inability to satisfy a woman. Therefore we recommend that male patient who will undergo the sterilization to have pre-operative counseling in order to correct misconception, and allay fears and apprehension regarding vasectomy or sterilization.

### **Intrauterine Contraceptive Devices (IUCD) or Intrauterine Device (IUD)**

Intra-uterine devices (IUDs) have been widely used in the last 3-4 decades. And to date it has been estimated that around 90 million women are using the device.

The first IUD described by Richard Richter was a ring made of silkworm gut. This was followed in 1934 by Ota ring and in 1959 by Grafenberg ring. The development of polyethylene, a biologically inert elastic plastic, paved the way for Margulies coil and the Lippes loop. The Lippes loop is provided with a string for easy retrieval and barium sulfate to render the device radio-opaque.

In the late 1960's, medicated or bioactive IUDs were launched. These devices carry substances such as copper or hormone and they were found to have lower pregnancy rates, less likely to be expelled, and produce less menstrual bleeding and pain.

The first copper IUDs have copper wire wrapped around the vertical stem of the plastic device. These include: TCU 200 (200 sq. mm. of copper), Cu-7 (200 sq. mm. of copper) and Multiload (250 or 375 sq. mm. of copper). Devices with 200-250 sq. mm of copper have a life span of 2-3 years while Multiload 375 has a recommended life span of 3 years.

Second generation copper IUDs likewise have been designed for a longer life span and better contraceptive effectiveness. They include:

1. TCU 380A – with two sleeves of solid copper on the transverse arm and a coil of copper wire around the vertical stem totaling 380 sq. mm. Of copper surface. (6 years)
2. TCU 380Ag – similar to 380 A, the copper wire though has a silver core to keep the copper from fragmenting. (10-15 years)
3. TCU 220C – seven solid copper collars – two on the transverse arm and five on the vertical stem. (15-20 years)
4. Nova T – 200 sq. mm. Copper wire with silver core wrapped around the vertical stem of the device. (10 years)

Copper sleeves on the horizontal arm of TCU 220C and TCU 380A bring the copper closer to the uterine fundus. The high fundal placement has improved effectivity since implantation normally occurs high in the uterus.

Progestin releasing IUDs eg. Progestasert - a T-shaped device containing 38 mg. of progesterone with daily release of 65 mcg. has the distinct advantage of diminishing menstrual blood loss and also relieving the dysmenorrhea. However, these devices cost more than the copper devices and need to be replaced after 1-2 years of use. They produce more intermenstrual bleeding and spotting. They are associated with higher rates of ectopic pregnancies.

#### **Mechanism of Action**

The contraceptive action of all IUDs is mainly in the uterine cavity. Ovulation is not affected. IUD is not an abortifacient. It is believed that the major mechanism of action for IUDs is the production of an environment (cervical, uterine and fallopian tube) that is spermicidal and no fertilization occurs.

#### **Timing of Interval Insertion**

IUD insertion either during or immediately after menstruation has the following advantages: (1) this assures that the woman is not pregnant; (2)



provides easy insertion considering that the cervical os is dilated and the endocervical canal is soft; and (3) bleeding as a side effect of IUD insertion is less apparent and thus less disturbing.

It is not, however, absolutely necessary to limit IUD insertion during the time of menstruation or immediately thereafter. Research studies have shown that rates of expulsion and pelvic infection are lower when IUDs are inserted later in the cycle. On the other hand, pregnancy rates and removal rates for bleeding and pain are slightly higher for insertion late in the cycle.

### **Postpartum Insertion**

High rate of expulsion is a problem with postpartum insertion of IUDs. The expulsion rate following insertion before 8 weeks postpartum was about double. The incidence of uterine perforation was higher when IUDs were inserted 4-8 weeks postpartum. With respect to bleeding, no significant differences in removal rates were noted between women receiving IUDs immediately postpartum and those with later insertions. With regards to pain and infection, the incidence were slightly lower among women with early than later postpartum insertions.

### **Post Placental Insertion**

Insertion of IUD immediately following delivery of the placenta is a convenient time for providing IUD since motivation for contraception is high and the patient does not have to come back a month or so for the insertion. There are, however, disadvantages which include: increased expulsion rate, unacceptable incidence of pelvic inflammation disease (PID), increased frequency of uterine perforation, and higher pregnancy rates.

### **Post Abortion Insertion**

IUD insertion after first trimester abortion does not cause increased expulsion, pregnancy, infection, bleeding or pain. Insertion following second trimester abortion causes higher expulsion rate.

### **Insertion at the Time of Cesarean Section**

Studies in IUD insertion at the time of cesarean section were undertaken in China and these showed expulsion rates at 12 months to be low (3.9 – 7.5), but pregnancy rates were higher (1.7 – 8.9 per 100 women). Insertion of TCu 220C at the time of cesarean section in Belgium showed zero pregnancy rate and expulsion rate of 7.7 at 12 months of use. The insertion of IUD should be discouraged when cesarean section follows prolonged labor or ruptured membranes because of the high incidence of pelvic infection.

### **Post Coital Insertion**

Copper devices were inserted up to 5-7 days after unprotected coitus. In 341 insertions, no pregnancy occurred.

## Side Effects and Complications

Just like any method of contraception, IUD has side effects and complications. These side effects and complications may be minimized by providing the devices to a selected group of women who are at low risk. The best candidate for IUD insertion is: (1) a woman in a stable marital relationship; (2) an older woman who has borne children, or (3) a woman not exposed to gonorrhoea or chlamydia nor has a history of severe dysmenorrhoea or profuse menstruation.

Likewise the quality of health services also influences IUD acceptability and safety. Skilled insertion, appropriate counseling and prompt management of complications make more difference than the type of devices.

**Bleeding.** The exact cause of increased bleeding in IUD users is not precisely established. It has been suggested that plasminogen activators become concentrated in the endometrium adjacent to the device. These enzymes increase fibrinolytic activity and prevent blood clotting thus increasing blood flow.

Mechanical pressure on the endometrium, on the other hand, has been thought to cause intermenstrual bleeding in IUD users.

**Pregnancy.** An intrauterine pregnancy occurring in an IUD user is more likely to end in spontaneous abortion than a pregnancy in a non IUD user. The risk of spontaneous abortion run to about 50%.

**Pelvic Inflammatory Disease (PID).** The relative risk of PID among IUD users is 1.5 – 2.6. The presence of threads attached to the IUD which pass through the cervical canal and into the vagina has led to the speculation that they may be the vehicle for ascending infection. To date, however, only one of five small studies comparing devices with and without tails has found a lower rate of infection in women with tailless IUDs.

**Uterine Perforation.** Although a rare occurrence, IUDs can perforate the uterine wall, migrate into the peritoneal cavity, or become lodged in the cervical musculature. The rate of perforation range from 0.6 -- 1.3/1000 insertions and to a large extent dependent on the following factors.

- Size, shape, and consistency of the device
- Insertion technique
- Timing of insertion and
- Skill and experience of the one inserting the device

Perforations are often silent and asymptomatic. It is suspected when IUD string is absent or when one is unable to pull the IUD by pulling the string. It can be detected by X-ray, hysteroscopy or ultrasound.

If uterine perforation has occurred, the IUD can be removed by either laparoscopy or laparotomy in the case of closed type IUDs or those containing copper. Closed devices can cause bowel obstruction while copper IUDs can elicit an intense reaction which could lead to omental adhesions. Opinions, however, varies widely on whether or not to remove a non-medicated device that has perforated the uterine wall.

**Expulsion.** Expulsion rates for IUD vary from 5-20 per 100 women at one year. They are influenced by: (1) Age and parity of the user; (2) Timing of insertion; (3) Interval after insertion; (4) Skill of the operator; and (5) Size and nature of the device.

Nulliparous women (those who have not borne children) have higher expulsion rates than multiparous women (those who have borne several children). Women under 30 years of age have higher expulsion rates than those above 30. Expulsion occurs most frequently during menstruation, when the uterus contracts forcing down the device.

Expulsion rate is higher with small devices than with larger devices of the same design. The copper-T device although of smaller size than the non-medicated Lippes loop have been shown to have a lower expulsion rate.

When expulsion occurs, it is advisable to try a different size or reshape of IUD. Progestasert T may be a good choice when other IUDs have been expelled because progesterone diminishes uterine contraction.

### **Contraindications to IUD Insertion**

**Absolute Contraindications.** These include (1) Active pelvic infection (acute or subacute), including known or suspected gonorrhea or chlamydia and (2) Known or suspected pregnancy.

**Strong relative Contraindications.** These include (1) Multiple sexual partners or strong likelihood that the woman will have multiple partners during the time that IUD is in place. (2) Desire for future children\*; (3) Emergency treatment difficult to obtain should complications occur; this would primarily be a problem in very rural areas; (4) Recent or recurrent pelvic infection, postpartum endometritis, or infected abortion within the past three months; (5) Acute or purulent cervicitis; (6) Bleeding disorders not yet definitely diagnosed; (7) History of ectopic pregnancy; (8) Single episode of pelvic infection if patient desires subsequent pregnancy; (9) Impaired response to infection (diabetes, steroid treatment, etc.); and (10) Blood coagulation disorders.

**Advantages.** Among the advantages of IUD are (1) highly effective; (2) convenient; (3) no systemic effects; (4) not related to intercourse; (5) relatively inexpensive; (6) easily reversible; and (7) quick return to fertility.

**Disadvantages.** Among the disadvantage IUD has are: (1) may cause side effects, bleeding or profuse menstruation; (2) may be expelled; (3) may cause complications – pelvic infections, perforation and pregnancy with device in place; and (4) effectivity of the Copper IUD is around 99.4%. When not used consistently and correctly used it has 0.8 % pregnancy rate.

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