



Barrier Methods of Contraception

Although abstinence remains the ultimate in barrier contraception, it is not always an acceptable option. To prevent unplanned pregnancies and the spread of sexually transmitted infections, physicians must have a strong knowledge of the different barrier contraceptives available.

By Jacqueline Hurst, BSc, MD

Worldwide, on a daily basis, there are 140 million acts of sexual intercourse.¹ The results of all this activity include 450,000 unplanned pregnancies (out of 950,000 conceptions), 356,000 infections and the release of an astronomical number of sperm.

For many individuals, an appropriate contraceptive method needs to combine both contraception and protection from sexually transmitted infection (STI). In this article the author will discuss the effectiveness of barrier methods regarding:

- Protection against pregnancy—quoted as a percentage of 100 women, and therefore couples, protected during one year of perfect use (Table 1 will also show typical use);² and
- The rate of genital STIs (syphilis, gonorrhea, HIV, chlamydia and trichomonas) and PID (pelvic inflammatory disease) in females, relative to chance.³ This is not to suggest that STI rates and their sequelae in females' male partners are unimportant — however, there is a lack of data on this topic.



One might argue that abstinence is the best of the “barriers” — 100% effective against pregnancy and STIs. If abstinence is not an option, then mechanical and chemical barriers are the next most effective methods for prevention of STIs and PID with the greatest reduction occurring when they are used in combination.



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Condoms

Male condoms

One of the oldest methods of birth and infection control is the male latex condom. If combined with spermicide (foam spreads the best) it is 99% effective against pregnancy. Without spermicide, it is 97% effective. The rate of STIs is decreased by 90%.² The rate of PID is reduced by 50%. Condoms containing spermicide do not provide any extra protection against STIs or pregnancy and may increase the chance of latex allergy, since the spermicide can cause an allergic protein to be released from the latex.⁴

The male polyurethane condom, in combination with spermicide, is 97% effective against pregnancy. Recent studies suggest that this condom is more effective against STIs than latex.

Natural (sheep) condoms are equally effective against pregnancy, but offer no protection against STIs.

Female condom

This polyurethane condom is 95% effective against pregnancy. In vitro studies suggest a decreased rate of STIs, including human papilloma virus (HPV) and herpes simplex virus (HSV), but no human studies have been completed as yet. As with the male polyurethane condom, it can be used with an oil-based (or water-based) lubricant (latex requires water-based as oil-based will disintegrate the rubber).

The female condom comes with lubricant already applied to both the outer and inner portions. Extra lubricant, which is included in the package, can be added if required.

Table 1
Barrier methods of contraception

Barrier method	Typical use effectiveness*	Perfect use effectiveness**	STI % decrease relative to chance**	PID % decrease relative to chance**	Cost***
Condom without spermicide	86%	97%	90%	50%	\$0.50
Condom with vaginal spermicide added	88%	99%	90%	50%	\$0.50 plus cost of spermicide
Cap-nulliparous	80%	91%	50%	62%	\$40
Cap-multiparous	60%	74%	50%	62%	\$40
Lea's shield with spermicide		91%	50%	62%	\$50
Lea's shield without spermicide		87%	50%	62%	\$50
Diaphragm	80%	94%	50%	62%	\$40
Female condom	79%	95%	no human studies	no human studies	\$4
Sponge-parous	60%	80%	no studies	no studies	\$2.50
Sponge-nulliparous	80%	91%	no studies	no studies	\$2.50
Foam	74%	94%	50% excluding HIV	50%	\$18 (20-25 doses)
Cream	74%	94%	50% excluding HIV	50%	\$20
Gel	74%	94%	50% excluding HIV	50%	\$20
Suppository	74%	94%	50% excluding HIV	50%	\$20
Film	74%	94%	50% excluding HIV	50%	\$2
Nonoxonyl 9	74%	94%	50% excluding HIV	50%	\$3
Withdrawal	81%	96%	HIV 50% — otherwise chance	0%	\$0

*Nelson AL, Hatcher RA, Ziemann M, et al: *Managing Contraception*. Bridging the Gap Foundation, Tiger, Georgia, 2000.²
 **Trussell J, Koenig J, Stewart F, et al: Medical care cost savings from adolescent contraceptive use. *Family Planning Perspectives* 1997; 29(6):55.³
 ***Sex Sense: *Canadian Contraception Guide*. Society of Ob. and Gyn. of Canada, 2000.⁷
 HIV = Human immunodeficiency virus

The female condom is inserted with the smaller ring over the cervix and the larger ring outside the vagina over the labia (thus the decrease in HPV, HSV potential).

Insertion can be done anytime up to eight hours prior to intercourse. It should be removed before standing up after intercourse. Prospective users should be warned that, dur-



ing intercourse, the polyurethane movement can be noisy. In addition, users must make sure that the penis is inserted inside the condom and not around the outside edge.

Cap, Lea's Shield and Diaphragm

These methods, when used with either a gel or a cream spermicide (not foam as it disintegrates the rubber), have been shown to decrease the rate of STIs by 50% (excluding HIV) and of PID by 62%. They are thought to work by two methods: preventing pooling of sperm at the cervix, therefore decreasing the sperm's ability for capacitation (sperm outer membrane joined with the acrosome), and disruption of sperm by the spermicide.

Cap

The cap is made of latex and comes in four different sizes (22, 25, 28 and 31). Its effectiveness against pregnancy, with spermicide

filling one third of the cap, is 91% in nulliparous women and 74% in multiparous women (*i.e.*, they are two times as likely to fail in parous women, particularly during the first year of use, despite no significant user difference). The cap is not effective during menstruation, perhaps due to the pooling of fluids. The best fit results in the cap covering the entire cervix, right up to the fornices, and grabbing around the neck. For many women, a suitable size isn't available.

The cap must be inserted at least 30 minutes prior to intercourse to allow for full suction (created by squeezing the end of the cap once it's on the cervix and turning it one-quarter turn) and it must remain in place for at least eight hours post-intercourse.

The cap provides protection for 24 hours without any further spermicide required, although adding more (into the vagina, not into the cap) may enhance effectiveness. The cap should be replaced every one to two years in spite of usage frequency. Odour can be a problem and is best solved by putting the cap in a solution of chlorophyll and water.

Lea's Shield

The Lea's shield is made of silicone (one size fits all) and is designed to sit in the posterior cul-de-sac and cover the cervix without actually resting on it. A one-way valve creates suction and also allows secretions to escape, thereby decreasing odour. Prior to insertion of the shield, the bowl should be filled about one-third full with spermicide. Although the shield provides protection for 48 hours, it should be removed within 24 hours to avoid toxic shock risk. Unlike the cap, this method

continues to work during menstruation, with an effectiveness rate of 91% against pregnancy, with the use of a spermicide, and 87% without.⁵ The shield can be inserted at any time prior to intercourse, keeping in mind the 24-hour wear limit, and should be left in place at least eight hours post-intercourse. No additional spermicide is needed with repeat intercourse. If lubrication is required, a water-based product should be used. The shield will turn yellow after approximately six months, in spite of washing it with soap and water. The valve area can be cleaned with a cotton swab. It should be replaced after six months.

Diaphragm

The diaphragm is composed of latex and a latex-covered steel ring and is available in four sizes (it used to be available in six sizes). It is inserted with the concave side facing the cervix. One tablespoon of spermicide should be placed in the concave side, either prior to insertion or with an applicator just after insertion (this latter method helps prevent spermicide getting on the labia). If more than three hours lapse prior to first intercourse after insertion, additional spermicide should be used. If intercourse is repeated, additional spermicide should be inserted in front of the diaphragm (*i.e.*, on the convex side). If all of these instructions are followed, the diaphragm is 92% effective against pregnancy. As with the cap and Lea's shield, the diaphragm must be left in place for at least eight hours after intercourse and should be left in no longer than a total of 24 hours. This precaution is not only useful for preventing toxic shock, but also for preventing urinary tract infections

(the rate of which increases, particularly in those with a prior history of UTIs) since the ring of the diaphragm pushes on the urethra.⁶

The sponge

The sponge combines a barrier method and spermicide in one product. It is made of polyurethane foam and its gel contains a combination of three spermicides (all low-dose so they are less irritating to the vagina): nonoxynol-9, benzalkonium chloride and sodium cholate. This method works by absorbing and trapping sperm (in the sponge itself) and destroying sperm (spermicide contained in the product). The sponge should be placed in the vagina at least 15 minutes prior to intercourse and provides protection for 12 hours (*i.e.*, a new sponge is needed if intercourse is to be repeated after six hours, as the sponge must remain in place for at least six hours post-intercourse). There is some suggestion that the risk of toxic shock increases after 12 hours, therefore it shouldn't be inserted more than six hours prior to intercourse.⁷ The sponge is 91% effective against pregnancy in nulliparas and 81% in multiparas. There are, as yet, no studies that the author is aware of regarding STI and PID prevention.

Spermicides

Available spermicides work by detergent action on sperm and, therefore, also irritate the vaginal wall. Although most STIs and PID are decreased by 50% with the use of spermicides, there is potential for an increased rate of HIV. Spermicides can cause vaginal epithelial changes and genital ulceration.⁸ Since ulcerations are associated with an

increase in HIV transmission, frequent use of spermicide could leave the individual more vulnerable to HIV (and also bacterial vaginosis). Effectiveness against pregnancy has been reported as high as 94%, with a higher failure rate during the first six months of use. All spermicides should be inserted high into the vagina, hopefully over the cervix (where they will have a barrier effect as well as a detergent action). All spermicides need to be inserted at least five minutes prior to intercourse to allow for dispersal time.

Spermicidal foam, cream, jelly, suppositories and tabs are made of two components; an inert base that ensures dispersion and holds the spermicidal agent in the vagina and a spermicidal chemical—creams and gels contain 2% to 6% nonoxynol 9, foam 12%. Foam spreads more easily, thereby accounting for its increased effectiveness with condom usage (from both its percentage of nonoxynol 9 and spread). Foam will disintegrate rubber or silicone, in the long term, and can't be used with caps, diaphragms or Lea's shields. Creams, gels and foam remain effective for one hour when used "solo," but longer when used inside a cap, diaphragm or shield.

Vaginal contraceptive film contains 72 mg of nonoxynol 9 and comes in a 5-cm by 5-cm sheet. It is most easily inserted by folding it in half, then in half again.

Bio-adhesive gel uses a bio-adhesive technology (with a low dose of nonoxynol 9 [3.5%] and some lubricant). It remains effective for 24 hours, but only for one act of intercourse (*i.e.*, it must be replenished if intercourse occurs again). It comes in a disposable

applicator, which holds the correct dose, and it should be applied at least 30 minutes prior to intercourse.

Withdrawal

A final method, and arguably not a real barrier method, is withdrawal. It has been included since the end result is an avoidance of "egg-sperm" togetherness.

Withdrawal, or *coitus interruptus*, is 81% effective against pregnancy. It has recently been determined that the pre-ejaculate contains no sperm, but that a previous ejaculation can leave sperm hiding in the folds of the urethral lining.² Therefore, the male should urinate and wipe the tip of his penis to remove any of the remaining sperm prior to using withdrawal a second time. Ejaculation post-withdrawal must occur away from the introitus. Some studies suggest this method offers a 50% reduction in HIV infection from male to female.⁹

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