The Linacre Quarterly

Volume 16 | Number 1 Article 5

January 1949

The Cervical Spoon ... an Aid to Spermigration and Semen Sampling

Joseph B. Doyle

The Cervical Spoon . . . an Aid to Spermigration and Semen Sampling

Joseph B. Doyle, M.D.

Director, Sterility Clinic, St. Elizabeth's Hospital;
Assistant in Obstetrics, Tufts College Medical School;
Junior Visiting Gynecologist, St. Elizabeth's Hospital;
Junior Visiting Gynecologist and Obstetrician,
Boston and Cambridge City Hospital

Preliminary Report

It is generally agreed that the male contribution to the achievement of pregnancy consists of the successful deposition of a quantitatively and qualitatively adequate seminal ejaculate deep enough in the vagina to permit sperm migration from the seminal pool through the cervical mucus to the uterus and tubes. The presence of the largest number of viable motile sperm in the distal end of the tubes at the time of ovulation is the best assurance of fertilization. The "spreading" enzyme hyaluronidase is believed to be released by the dying unsuccessful sperm candidates in an amount adequate to dissolve the hyaluronic acid, a jellylike complex, that holds the residual granulosa cells of the follicle to the ovum recently released by the ovary. The denuded ovum is thus available for fertilization by the remaining sperm in the tubal fluid whose *p*H is 7.2 to 7.5 at ovulation time.[1]

Direct insemination of the cervix is unlikely, for actual interlocking of the penis and cervix is rarely possible.[2] More usually, the ejaculate (average *p*H 7.39)[3] is deposited in the vagina (*p*H 4.0 to 5.0) and gravitates to the posterior fornix where the mixture of the ejaculate, vaginal secretion, and cervical mucus forms the "seminal pool" (*p*H 5.6 to 6.2 depending on the relative volume and *p*H of these constituents).[4] We have found the *p*H of the usual pool to vary from 4.5 to 6.5. Since seventy-five per cent of the sperm are in the first forty per cent of the ejaculate,[5] and the first few drops are the most heavily populated, the best of the sperm population is thus exposed to neutralization and immobilization by the acid vaginal secretion often before the complete liquefaction of the seminal fluid (average thirty minutes)[6] permits maximum sperm motility to be

From the Department of Obstetrics, Tufts College Medical School, and the Sterility Clinic, St. Elizabeth's Hospital, Boston.

(Bulletin of the New England Medical Center X: 225-231, *Oct.,* 1948*)*

achieved. The surviving residual active sperm ascend through the overlying fluid, mostly prostatic and seminal vesicular secretion, to the cervical mucus (which increases in amount, fluidity, and penetrability at the ovulation phase),[1,7,8] and drips down to make contact with the pool. Some sperm penetrate the endocervix (they have been recovered from the uterus in three minutes);[8] others die or linger sluggishly in the mucus of the os, where the *p*H varies from 7.0 to 7.5 at ovulation time (*p*H 6.0 to 7.5 according to Reich et al.[9]).

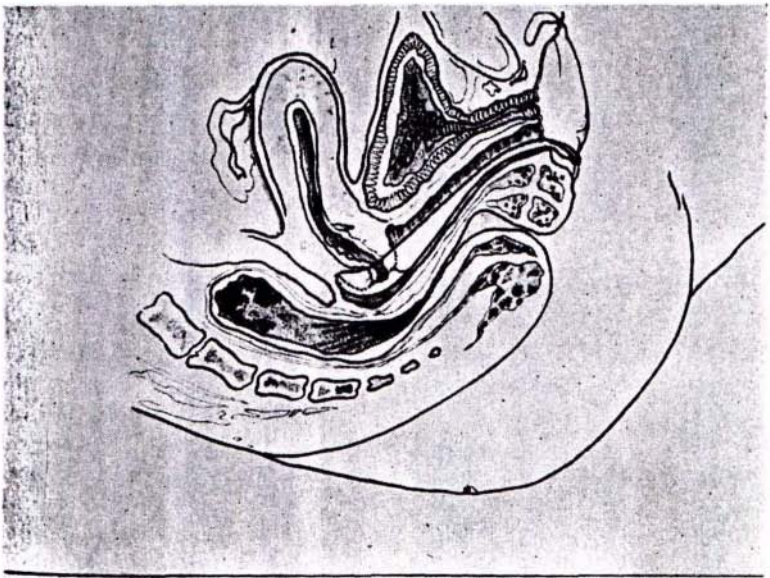
If the ejaculate could be deposited in contact with cervical mucus under circumstances where the acid vaginal secretions could be minimized or eliminated, the presence of increasingly large numbers of active sperm in the cervix and the prolonged survival and activity of more sperm in the pool would demonstrate maximal migration and greater possibilities for fertilization of the ovum. There would then be an unbuffered isoionic alkaline internal fluid matrix for spermigration in large numbers over a period of hours that would more nearly approximate physiologic homeostasis than the usual buffered pool where few sperm survive after one hour[6] or, at the most, ten per cent after two hours.[4] Physiologic homeostasis can be so achieved by providing a continuous isoionic fluid matrix for sperm migration through the use of a cervical spoon. Such a method is now presented.

A concave lucite spoon has been devised to provide an innocuous inner lining of the posterior fornix and vaginal wall. It is inserted in the vaginal canal, its shaft gently depressed by flexion of the index finger against the relaxed perineum and posterior vaginal wall as the patient gently bears down. The cervix can be digitally felt as it dips into the spoon. The procedure is demonstrated to both husband and wife in the physician's office, where at probable ovulation time as determined by calendar calculation, thermal shift, and/or vaginal smear or cervical mucus study, the vagina is wiped dry and free from accumulated debris. A clean vaginal tampon is left in place to absorb the secretion until the patient is ready for coitus at home. Before coitus, the husband places the spoon (which has first been washed in hot tap water and allowed to dry) beneath the cervix. Intromission from above is readily attained. Deep gentle penetration with minimal coital movement will result in the deposition of the ejaculate into the spoon where it mingles freely with the cervical mucus. The levator ani and vaginal muscles elevate the contents of the spoon to mix with the mucus of the cervix (see figure). Repeated voluntary contractions of these muscles are optional. The wife remains supine for at least one hour. Then the

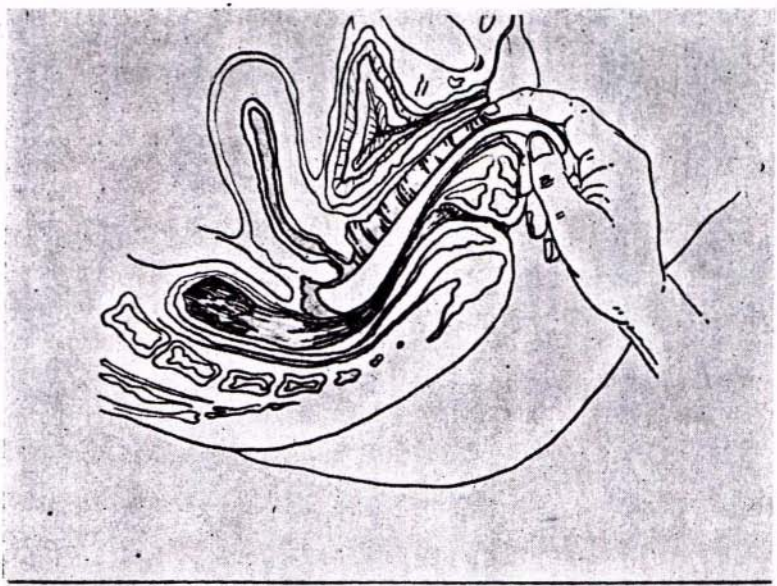
spoon is withdrawn by the husband as the wife gently bears down to relax the perineum. The contents of the "seminal spoon pool," liquefied ejaculate plus minimal cervical mucus and a trace of vaginal secretion, are deposited in a clean boiled glass jar for study of viscosity, sperm count, morphology, and viability. The jar must be tightly capped to prevent escape of CO_2 if *p*H is to be maintained.

Our studies reveal that the cervical mucus at ovulation time has a *p*H of from 7.0 to 7.5 by the nitrazine method. The *p*H of spoon semen samples varies from 6.5 to 7.5, virtually isoionic with cervical mucus. Motility and metabolism of the sperm are unaffected at *p*H 6.7 to 7.7.[3] By contrast, the *p*H of the usual seminal pool (4.5 to 6.5) is not the optimum *p*H probably required by sperm from infertile husbands. When *p*H is lowered, sperm activity is reduced.[3]

Few sperm survive in the vagina after one hour;[6] not more than ten per cent are viable after two hours.[4] Spoon semen samples collected after the spoon was left one to five hours in the vagina show fifty to eighty per cent of the sperm active. Fresh specimens withdrawn within thirty minutes and left standing in the spoon within a large stoppered jar for five hours at room tem-



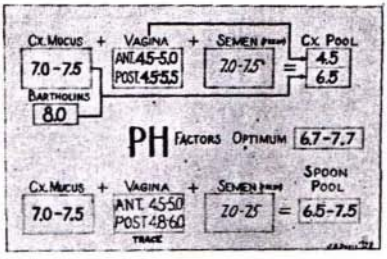
SPOON ELEVATES POOL TO CERVIX.



PLACING SPOON IN POSITION.

perature show little change in motility, indicating that the lucite spoon is not deleterious to the sperm.

Through the use of this pro-



cedure, a virtually isoionic continuous fluid medium at optimum body temperature is thus available for prolonged survival and continuing penetration of more numerous sperm through the cervical mucus. Fertility has been improved by better spermigration after alkaline douches of inexact isoionicity. By keeping more sperm alive in an almost isoionic medium of optimum viscosity and temperature that can be maintained for several hours at determinable *p*H, the spoon preserves the maximum population potentiality for cervical penetration.[1,8]

Hotchkiss[3] says, "The motility of the spermatozoa in the test tube is only presumptive evidence that their activity in the cervix will be comparable. An inadequate seminal pool, improper deposition of the semen, viscid or hostile vaginal and cervical secretions, may discount the accuracy of

assuming that motility is satisfactory for uterine migration, even though the test tube sample of semen exhibits satisfactory motility of the spermatozoa. The ideal system of semen collection would permit a sample to be produced in contact with substances found in vivo and preserved under the same conditions of gas tension found in the human genital passages. The *p*H should be regulated to that in vivo and the temperature at approximately 37.5 C." At ovulation time the cervical mucus is increased from two to ten times in volume, less viscid and more penetrable.[1,7] Hence, if the spoon is withdrawn within one hour, the sample at ovulation time is a mixture of liquified seminal fluid and cervical mucus, a more physiologic medium for viability study. If obtained in the premenstrual or early postmenstrual phase, the sample will contain minimal mucus which is then scant and viscid, and will be a good medium for a count and morphology study of a pure seminal fluid. MacLeod[10,11] has shown that spermatozoa require a utilizable carbohydrate such as glucose, fructose, maltose, or glycogen as a substrate in order to maintain sperm motility. Huggins[12] has demonstrated that in the semen this carbohydrate is mainly fructose from the seminal vesicles and is found mainly in the terminal half of the ejaculate. Besides maintaining optimal *p*H, the cervical spoon pool preserves the vital fructose and enzymes, for example, fibrinolysin and hyaluronidase which are not infrequently diminished by partial or complete effluvium seminis.

Twenty-four tests on twelve infertile couples were conducted at approximate ovulation time. No case was rejected because of other infertility factors, male or female. The sole criterion was deficient spermigration as indicated by the cervical mucus sperm count at eight hours postcoitus (the Huhner test). In previous eight-hour postcoital tests, four showed no sperm per high power field, due to effluvium seminis, four showed one sperm per high power field, two showed five, and two showed ten.

Table I shows the count of active sperm per high power field in the deep cervical mucus eight hours postcoitus and the percentage of active sperm survivors, remaining in the spoon at the same eight hours postcoitus after varying lengths of contact time of cervical mucus and ejaculate in the spoon.

TABLE I.—EIGHT-HOUR SURVIVAL OF SPERM

Number of tests	Spoon contact	Average sperm/HPF	
		Cervix	Spoon pool
12	—	0-10	—
12	1 hour	18	70%
8	2 hours	65	62%
3	3 hours	100	66%
1	5 hours	125	50%

In two five-hour contact tests of fertile couples in the late phase of the cycle, the number of active surviving sperm in the spoon was respectively eighty and ninety per cent when viewed within one hour, and seventy-five per cent when viewed for uniformity eight hours postcoitus. It is therefore estimated that fifty to seventy-five per cent of active sperm survivors are available in the spoon pool for continuing the sperm invasion after five hours of cervical mucus contact. There is also definite increased motility in the sperm found in the cervix when the spoon is used, a quality MacLeod has shown to be paramount for semen evaluation.

The spoon has been seen to completely prevent effluvium seminis. Two cases are presented as examples.

Case 1.—One Hour Postcoital Tests

	Normal coitus		45-min. spoon contact	
	*p*H	sperm/HPF	*p*H	sperm/HPF
cervix	7.5	0	7.5	5-15 very active
post. fornix	4.5	0-1 dead	5.5	20-30 dead
			spoon 7.0 pool	70-80 very active 20-30 dead
introitus	5.0	5 dead	5.0	none
effluvium	prompt		absent	

Case 2.—Five Hour Postcoital Tests

	Normal coitus		One-hour spoon contact		Two-hour	spoon contact
	*p*H	sperm/HPF	*p*H	sperm/HPF	*p*H	sperm/HFP
cervix	7.5	0-1 dead	7.5	5-10 active 0-5 dead	7.5	50-70 very active
post. fornix	4.5	0-2 dead	7.5 (spoon pool)	70-80 75% active	7.0 (spoon pool)	60-80 75% active
introitus	4.5	2 dead	4.5	none	4.5	none
effluvium	prompt		absent		absent	

Semen collection by the spoon has none of the disadvantages of the condom-coital method that is notoriously deleterious to the sperm motility and viability.[3] It has none of the personal, esthetic, or moral objections raised by not a few men to coitus interruptus and masturbation for the collection of a specimen of seminal fluid ejaculate, a medium that is not as complete a physiologic or functional vehicle for sperm viability as is the postcoital cervical spoon specimen whose sperm are true survivors at the body temperature at the time of the sperm invasion process. The spoon method as described meets the approval of church moralists[13] for it is proconceptive, permits marital intercourse, and does not prevent but rather enhances spermigration by providing a continuous virtually isoionic (*p*H6.5 to 7.5) physiologic medium of optimum viscosity at body temperature.

It is no longer necessary to needlessly sacrifice in the vagina large numbers of the precious few available sperm from the unfortunate infertile husband. The spoon should be useful to aid deep deposition of seminal fluid in such male deficiencies as hypospadia, small penile size, premature ejaculation, small volume ejaculation, and oligospermia, by providing a protected trough for the ejaculate to reach the cervix. A relative increase in the effective migrating sperm population can be achieved. The spoon helps motility through preservation of maximum fructose and enzymes and by enabling the seminal fluid and cervical mucus to blend as the physiologic fluid matrix.

SUMMARY.—This is a preliminary report of a new method for maximum utilization of the migration potentiality of the semen. The Cervical Spoon aids sperm deposition, sperm survival, and sperm migration. The method is simple and acceptable psychologically and morally. A physiologic postcoital sample is available for semen analysis, specially for motility and viability assay.

REFERENCES

1. ABARBANEL, A. R., *Tr. Am. Soc. Study of Sterility* (1946), p. 46.
2. DICKINSON, R. L., *Human Sex Anatomy*, Baltimore: Williams and Wilkins Company, 1933.
3. HOTCHKISS, R. S., *Fertility in Men*, Philadelphia: J. P. Lippincott, 1944.
4. ZEIGLER, S. L., *Fertility in Women*, Philadelphia: J. B. Lippincott, 1944.
5. MACLEOD, J., AND HOTCHKISS, R. S., *J. Urol.* 48:225, 1942.
6. MAZER, C., AND ISRAEL, S. L., *Diagnosis and Treatment of Menstrual Disorders and Sterility*, ed. 2, New York: Hoeber, 1946.
7. POMMERENKE, W. T., AND VIERGIVER, E., *Am. J. Obst. & Gynec.* 52:1023, 1946.
8. ———, ibid., 51:192, 1946.
9. REICH, W. J., WILKEY, J. L., AND HECHTOW, M. J., *J. Indiana M. A.* 40:842, 1947.
10. MACLEOD, J., *Am. J. Physiol.* 132:193, 1941.
11. MACLEOD, J., *Endocrinology* 29:583, 1941.
12. HUGGINS, C. B., AND JOHNSON, A. A., *Am. J. Physiol.* 103:574, 1933.
13. FORD, JOHN C., S.J., Professor of Moral Theology, Boston College, Personal Communication.