

SIMPLE STERILIZATION OF WOMEN BY CAUTERY STRICTURE AT THE INTRA-UTERINE TUBAL OPENINGS, COMPARED WITH OTHER METHODS¹

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SUMMARY

CONTRACEPTIVE measures are difficult to establish as the invariable rule because of their handicaps, the self-control demanded under emotional stress, and a degree of uncertainty accompanying each procedure. Section of the vas deferens, though simple, is not accepted by the male, and mere ligature cuts through. Also, of the pair, he is not the one who requires safeguarding. Ovarian shrinkage by X-ray is neither sure nor is its duration determined. Chemical slough stricture inside the upper uterine angles as advised by Froiep in 1850 was given up, but is worthy of new study. The various operations on the fallopian tubes involve opening the abdominal cavity from above or below, which is never justifiable for this purpose alone, while most of the women for whom it is indicated are poor subjects for operation. Moreover, operations call for the hospital and weeks of disability and may be followed by dragging adhesions; and there is a small percentage of danger to life. The only outlook for a simple and sure method, and that without risk or loss of time and with but little pain, seems to be through closure of the tube, where it enters the uterus, by a stricture produced as the result of a burn with the fine-tipped cautery electrode, a procedure simple enough to be done in the office. Of course all sterilizing measures are predicated on childbearing, in any given instance, being a grave risk to life or productive of permanent ill health.

Steps of procedure. Time selected, 7 to 10 days after period (for least vascularity and thickness of lining).

Location. Hospital, if the patient is sensitive; office, usually.

Technique.

- (1) Loose clothing, empty bladder.
- (2) Lithotomy posture (or Sims).

- (3) Bimanual examination.
- (4) Sims speculum, tenaculum in cervix.
- (5) Injection of 5 to 10 minims 10 per cent novocaine adrenalin solution into uterus with Skene intra-uterine pipette and pressure; also application to vaginal cervix and vagina, as anæsthesia controls. After 10 minutes and due bleaching proceed to—
- (6) Test the shape and length of cavity by ordinary uterine sound; this length noted.
- (7) Slide on cautery sound goes to same measure.
- (8) Burn of some spot on external os, with slight pressure, until wire tip is buried, to serve as a cautery control. Note time needed.
- (9) If cervix is hard, burying of tip in an anæsthetized place on the vaginal wall as control. Note of required time.
- (10) Cautery sound passed to cornu; held there, without pressure, the same length of time as needed to bury wire tip in cervix or vagina, with same amount of current.
- (11) Repeated on opposite side.
- (12) Watching slough and scar form on cervix or vagina. When firmly contracted, one may be able to test the tubes for patency by the Cary method—injecting a silver solution into the uterus under pressure, and securing an X-ray shadow of the distended uterine cavity, and also of the tubes, if they are open.

STERILIZATION OF WOMEN

A bare outline of the various procedures follows:

(a) By opening the abdomen; (b) by intra-uterine treatment.

(a) *By opening abdominal cavity.* (1) *Removal of the ovaries* is inexcusable if the ovaries are sound, as disturbances of sudden climacteric and sexual apathy result. This method has been abandoned.

(2) *Removal of the uterus*, leaving ovaries and feelings intact, is unwarranted except

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in case of tumor, uncontrollable bleeding, or bad prolapse.

(3) *Removal of the tubes* together with wedge at cornu is certain, but must be delicately done not to damage ovarian circulation with resultant shrinkages. It is not easily done in vaginal operations.

(4) *Exsection of portion of tubes.* (a) Of wedge at cornu, only. This is certain, but more surgery than in *b* and *c*. (b) With burial of proximal end under peritoneum; no pregnancies reported following it. (c) Simple removal of piece (best with proximal ligature only). This is practically certain, as only two pregnancies are known to have followed.

(5) *Ligature of tube*, single or double; some pregnancies follow—in women and lower animals. Any kind of tubal ligation or removal of a section (except into cornu) has resulted in an open end (42 per cent) and has occasionally been followed by restoration of continuity, but pregnancies following any tubal operation are infrequent enough to be curiosities. Any tubal ligatures may result in hydrosalpinx (although abdominal end of tube is wide open) as shown in animal experiments and in human beings.

(6) *Tubal ampullæ fastened into vagina*—on occasion of vaginal cœliotomy—has been rarely tried; in my patient, tenderness at these openings persisted.

(b) *By intra-uterine treatment.* (1) Obliteration of the whole uterine cavity by steaming (atmocausis) is difficult to control and has been abandoned.

(2) Atresia produced at entry of tube into the cavity of the body of the uterus by (a) chemical corrosion slough, circular scar closure; (b) cautery burn, slough, circular stricture—action on selected spots, area of damage readily kept within limits.

That there is a field for study and for better methods than we have had is shown by the difficulties with all other ways of safeguarding the woman to whom pregnancy means serious risk to life or health.

OBJECTIONS TO CONTRACEPTIVE METHODS

Unless we believe in asceticism, with marriage as a brother-and-sister relation, we must instruct patients in methods of birth-control.

The difficulty concerning these several methods, whether withdrawal, vaginal suppositories, womb veil, or stem, after-douche, or male cover, is that where most needed they are likely to be least used, and for two reasons; the forethought involved, the watchfulness never to be caught off guard, the self-control and unselfish consideration for the mate, are demanded of a man, a woman, or a pair swept away by passion; and, further, they are required of the rough workman or dull peasant. This is a big task in training, particularly as we must ask most of the least intelligent if we desire to breed up and not down. Always spontaneity of caress is to be coupled with preparedness; the enchantment with a measure of fearfulness.

Since the gratification is mostly on the part of the man (because of the present lack of premarital teaching and post-marital training and the dread of pregnancy always present) it is up to the man to accept the handicap—such as the cover. And the selfish man refuses.

After very considerable experience with solid, cylindrical, wholly intra-uterine stems (for anteflexion and for premature menopause, placed so that they may remain continuously for years) I make bold to voice the belief that we shall eventually adopt, as a means of security, the unintermittent wearing of some very simple Y-shaped device, entirely intra-uterine, easily placed or removed, while for temporary guarding we shall chiefly trust to the cover, tested and lubricated.

OBJECTIONS TO STERILIZATION OF HUSBAND

Let us pass by the question of defective and diseased males that should be sterilized. Let us grant for the sake of argument the general claim that since the male receives most gratification (in some cases all the pleasure and all the recurrent desire) therefore all the preventives should be his. Nevertheless one may yet hope to be able to suggest without offense that there is a basis for a scientific or legal stand to the following effect. Of the pair, since the woman is the one who needs safeguarding, the paralysis of the man's procreative (as distinguished from his

copulative) ability is beside the mark and is attacking the wrong end of the problem in the married.

A claim may also be made for immunity from sterilization on the part of the husband which he could hardly, with good grace, voice himself; namely, the possibility of future marriage and the desire for progeny from such marriage. This reasoning would apply particularly when the wife is an invalid — less to her who has overborne.

For the male there is a relatively uncomplicated method of sterilization with slight loss of structure or of time. Vasectomy, or the removal of a piece of the conduit above the testicle, as it runs close under the skin of the scrotum, by the use of local anæsthesia, has become a standardized procedure and has been accepted by the laws of several states for the sterilization of the defective and the criminally insane. For the man who desires a method which would permit of resumption of function, should he care to have children later, reuniting of the cut ends has been proposed (or else simple ligation of the duct). Through a small incision in the scrotal skin the vas deferens is brought to the surface. A fine silk or linen ligature or silver wire is passed about it and drawn snugly enough to obliterate the caliber of the duct but with intention not to cut it through. The ends of the ligature are cut close, the duct dropped back, and the skin closed. The ligature becomes encysted. A test made of the semen shows all other elements, and unaltered bulk, but no spermatozoa. If at some subsequent time it is desired to resume this capability for fertilization, the wound can be reopened and the little ligature cut off. But experiment has shown that, as with other ligatures, with mucous lining in apposition with mucous lining, and particularly with pressure from behind, it is difficult or impossible to shut off a canal.

While criminals can be forced to submit to the operation it does not prevent their living a loose sexual life. It may indeed foster such license, since cohabitation is safeguarded from the danger of impregnation. But it does prevent the degenerate

and the criminal thus treated from propagating their kind. The trouble with either operation, as one sees it in practice, is that although many a husband comes begging for a sure means of prevention after he has produced four or five children, or because of his wife's tuberculosis or Bright's disease, yet no man has been found willing to submit to the operation in this writer's experience and in that of many others.

As to the uncertainty of ligation of the vas deferens, all the data bearing on the difficulty or improbability of closing a duct by mucous apposition would apply; also no ligature except silver wire will last. Fraenkel's animal experiments have an interesting bearing. Silk, if too thick, suppurates; if too thin, absorbs. Thick silk tied with moderate pressure cuts into the canal of the fallopian tube of rabbits. In 4 cases, with silk, the canal was found broken into in 15 to 20 days. In 8 cases using thick silk, the lumen was present within 23 to 90 days. There were experiments on 26 rabbits on a tube 1 to 2 mm. in thickness and therefore comparable to the vas deferens. In some few cases Fraenkel cut the tube or cut out sections of it or even used the cautery, yet he could not close the canal except in rare instances. With these various methods, 42 per cent of these fallopian tubes stayed open. In more than one-half of his ligated tubes the ligature worked in far enough to open the lumen, there being no difference between thick and thin silk; the opening into the peritoneal cavity occurring under the knot or opposite it. Once, plain catgut was found present at 157 days and once silk absorbed in 14 days. He suggests silver wire or silkworm as a more permanent ligature. In one case No. 14 iron dyed silk had cut across the tube and lay all outside it, the re-established tube with its lumen perfect, the ligature and its knot intact and encapsulated.

That simple removal of a piece of the vas may not suffice is shown by the following instances. In two cases Fraenkel cut a gap out of the fallopian tube of the rabbit $1\frac{1}{2}$ cm. long, yet these tubes remade themselves perfectly macroscopically and microscopically. With double ligature and simple section

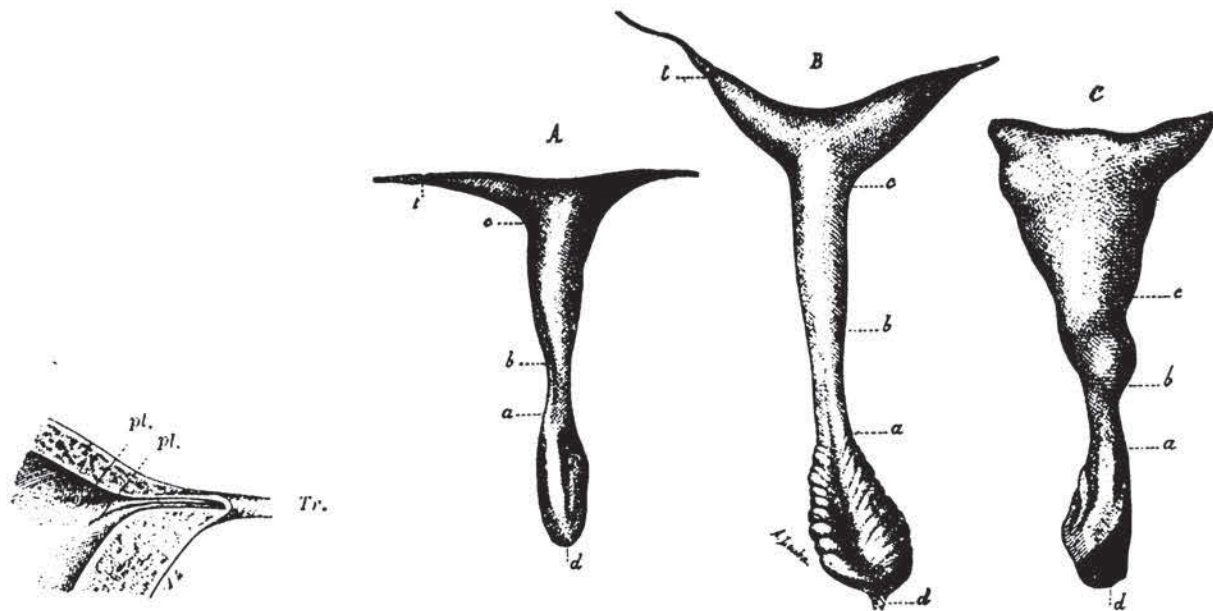


Fig. 1. Orifice of the tube open and spread out to show the longitudinal folds (Guyon). Virgin uterus.

Fig. 2. Casts of the uterine cavity (natural size), after Guyon. *A*, Cast of uterine cavity of virgin 17 years old; *c*, cornu of uterus; *cb*, inferior segment of body; *ba*, isthmus; *ad*, cervix; *t*, tubes, slight narrowing at the point of junction of their cavity with that of the body. *B*, Cast, nullipara 42 years old. The same letters for the same parts. The horns are longer and the superior segment more developed. *C*, Cast of cavity of uterus of multipara (same organ as Fig. 5) triangular form of cavity of body; enlargement and deformity of the uterine horns.

no restoration occurred. In animals there is easier regeneration of organs than in man: yet Zweifel's woman showed just such reconstructive power in her tube. Double ligature and a simple cut across would seem to be indicated. This would facilitate a reuniting later, if such were desired, though success is doubtful.

OBJECTIONS TO OPERATIVE STERILIZATION OF WOMAN

Every laparotomy involves a certain percentage of risk, however simple the procedure undertaken inside the abdomen. There is always the possibility of bowel adhesion or of omental drag, and these adhesions may give more or less discomfort. There can hardly be more than one answer to the question whether a method with any death-rate at all—small as that rate may be—and possible complications afterward, is justifiable when done largely for the safeguarding of sexual gratification on the part of husband and wife. No man of fine feeling would ask his wife to submit herself to such a risk, even with

powerful physical impulses on her side. Nor is it to be forgotten that a laparotomy, even a simple one, involves from one to three weeks in bed, and even with a cross incision like the Pfannenstiel, with its hidden scar, care needs to be taken for some months on account of the possibility of hernia.

For the sterilization of women all the procedures, save one, have involved entering the peritoneal cavity through an abdominal incision or through a vaginal incision. In either case the tubes are tied, or else tied and cut and one end of each buried. Or the tubes are removed. Removal of the tube is so likely to disturb ovarian circulation, and so prolongs the operation, that the most popular method is double ligature and burying the proximal ends. Ligature with section without burying has resulted in some cases in a reopening of the tied tube and pregnancy has followed. It is said to be possible to restore a tube by approximating the cut ends or by insertion of the cut end into the uterine cavity. It should be made clear, however, that success under these conditions is problematical.

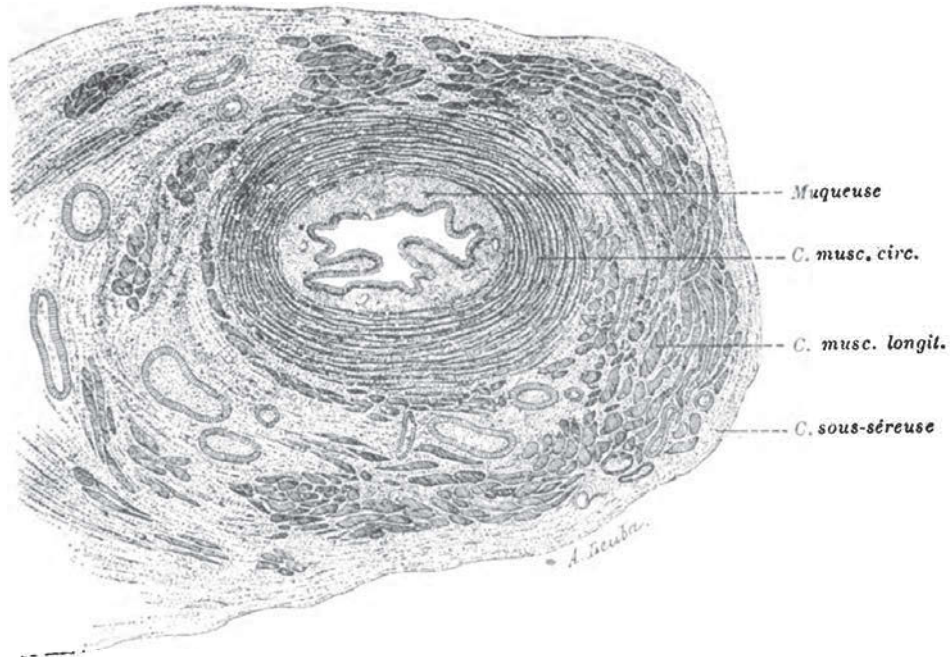


Fig. 3. Transverse section of the tube near the uterine orifice (Orthman).

Strictures produced at the uterine cornu call for certain preliminary considerations, anatomical and pathological.

ANATOMY

Testut states that the inner opening of the tube scarce permits the introduction of a boar's bristle. Poirier and Charpy say "the ostium uterinum measures about one millimeter in diameter and is impossible to catheterize in the living [Floekinger's case excepted and accepted] and even difficult to see in the dead, and is often closed by very thin mucus" (Fig. 1).

"In the nullipara one sees in the incised organ that the intramural segment, analogous to the uterine cornu of animals, resembles a funnel (Fig. 1) opening toward the cavity of the uterus. The narrowest part of the tubal canal (which is the ostium uterinum in the multipara) is found in the nullipara some millimeters further and not exactly at the superolateral part of the cavity of the uterus" (Richard). While most of our sterilizing is done for the multipara, it will thus be seen that for the non-parous uterus a smaller tip and greater care are needed, lest we place the stricture too low and leave blood from

menstruating membrane to back up behind it. Guyon's casts show the differences (Fig. 2).

"The mucous coat," says Testut, "lines the muscular coat of the tube and adheres to it entirely without a connective-tissue layer between. There is scant folding in the interstitial section. In the intervals of the folds the mucous membrane measures 0.1 mm. to 0.2 mm. in thickness" (Fig. 3).

Our deliberate inquiry has, however, chiefly or only to do with the mucosa of the cavity of the uterus at a point as far into the angle as we can penetrate with a blunted tip without force. To quote Testut further, "the mucous membrane of the body of the uterus adheres intimately to the muscular coat beneath it; but it is very friable and consequently alters easily. Its thickness at the middle of the uterus, where it attains its maximum, is 1 to 2 mm.; from there it diminishes gradually in passing toward the superior angles. At the level of the entrance of the tubes it is hardly 0.5 millimeter."

"The thickness of the walls of the uterus, elsewhere in the corpus averaging 10 to 15 mm., is at the opening of the tubes only 8 mm. (Sappey) The width of the transverse diameter is 25 mm. between the tubes.

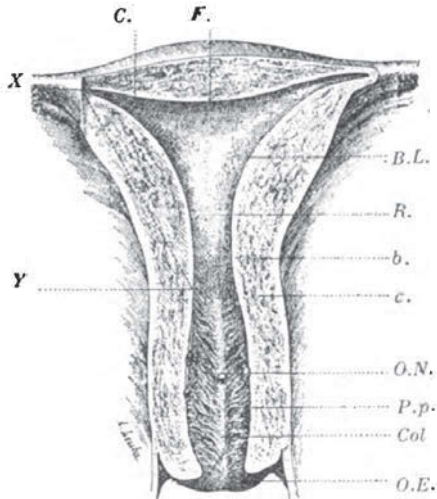


Fig. 4. Cavity of uterus of virgin, posterior surface natural size. *pp.* Palma plicatæ clearly defined, *O.N.*, Nabothian glands (Guyon, Rieffel).

. . . . The uterine cavity of the multipara has a triangular shape like that of the nullipara but less regular According to Guyon, Hageman, and Mauclairé this cavity becomes enlarged (or at least the uterine horns descend, in a sense, so that if from the extremity of the horns of the uterus one draws (in a virgin) a straight line to the internal os (Fig. 4, XY) one will have nearly the form of the cavity of the multipara (Fig. 5): the uterine horn has not disappeared but widened or enlarged.”

CLOSURE OF THE INNER END OF THE TUBE BY DISEASE

All the authorities agree that in hydrosalpinx or pyosalpinx obliteration of the lumen of the tube at the uterine end practically does not occur (Albers, Reymond, Landau). Closure is produced only in a mechanical way, by kinking. Atresia (absence of any opening) by the shut-down of a scar (*narbige Einziehung*) or adhesion (*Verwachsung*) is rare (Fromme and Heynemann, Veit's *Handbuch*).

There is an ample literature well illustrated for the closure of the fimbriated ends of the tube, but only a paragraph or a sentence given by each writer concerning the pathology, macroscopic or microscopic, of the inner end of the tube. A reasonable search found no picture of a section of a sacto-salpinx that cut through fundus and interstitial and uterine

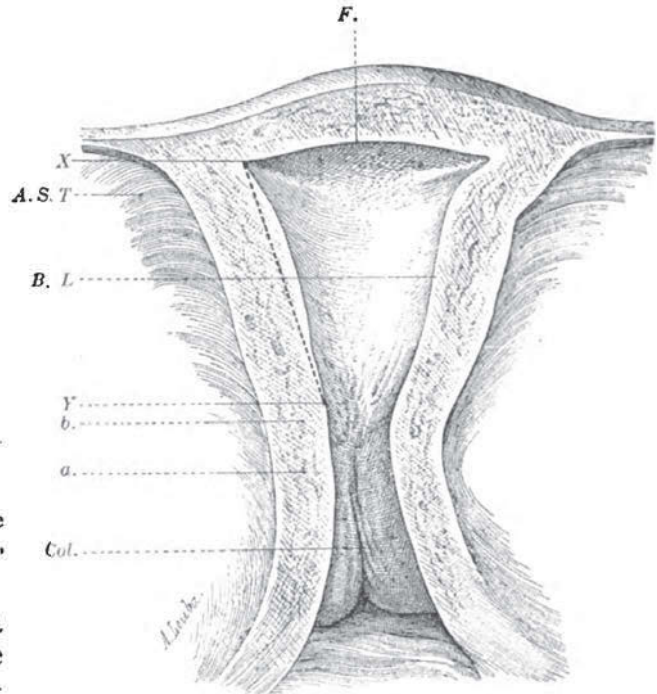


Fig. 5. Cavity of the uterus of a multipara; natural size. Triangular form of the body; folds of the tube radiating in the superolateral angles; double column of the palma plicatæ (Guyon).

portions of the tube and its sac. Our total find is one diagram of Reymond's that does not take in the cornu. Microscopic sections exhibit the kinked tube, where the lumen is shown two or three times in the same slide. In practice the pathologist's contention is borne out by authentic but most uncommon cases, beginning with Frank's in 1840, in which the tube empties its contents into the uterus. The anatomic proof was furnished by Rokitansky and Klob.

CLOSURE OF THE TUBE BY LIGATURE

The classic experiments are Fraenkel's, embracing 33 operations on 26 rabbits. The tubes of the higher mammals are very like the human, histologically. Those of the rabbit are 1 to 2 mm. thick. He found that notwithstanding favorably placed strands and tight ligatures one does not often succeed in interrupting the lumen of the canal of the tube. Whether with section or with ligature, tight or loose, thick or thin, of catgut, or silk, or rubber, atresias were accidental and rare. Forty per cent of the canals stood open into

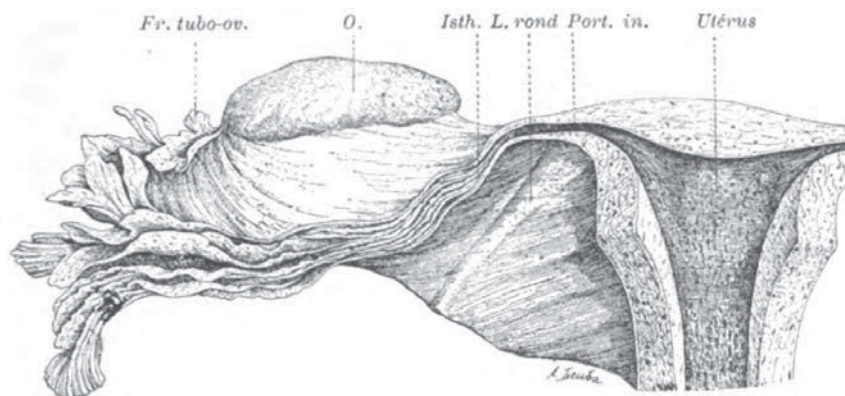


Fig. 6. Right tube cut open throughout its length in a multipara (Richard).

the peritoneal cavity, and a ligature could cut through and the canal repair itself. In two of the cases the cutting away of a section 1.5 cm. long resulted in a re-established channel. He was not able to use the hot wire to cauterize the lining because the caliber was too narrow. Ten to fifteen per cent of his ligated tubes ended in hydrosalpinx, though the ampulla was open. He counsels omission of a ligature on the cut end of the distal portion if section is done. For sterilization Fraenkel recommends removal of a wedge at the cornu and favors removal of the whole tube with the wedge. The reopening of the tube coincides with general operative experience in part, since, rather as curiosities, a small number of pregnancies have been reported after ligation or amputation of the tubes.

EXPERIMENTAL CLOSURE BY CAUTERY

Experiments upon animals to test cautery stricture are unsatisfactory because of the bicornate uterus, with the tube a continuation of the uterus, there being no cornu as it exists in the human uterus. Their uterine musculature is so thin, compared with the bulging thickness of the human uterine wall near the cornu that it is not possible to make adequate comparison. The only advantage in animal experimentation is that the abdomen can be opened and the action of the cautery observed through these thin-walled structures. One difficulty with observations on the ape consists in the high cost of all the larger monkeys. Therefore our preliminary studies will

be mainly restricted to the application of this method to patients with reasonably symmetrical uteri which will subsequently require to be taken out for the hæmorrhages of the menopause; that is, the persistent bleeding of arteriosclerosis or chronic metritis which is not relieved by curetting. I made this test also with a small fibroid uterus, but on one side the cautery tip ran up beneath a submucous fibroid and lodged there (Fig. 7). The test cannot well be made in the operating room after curetting has been done because of the oozing but on such a menorrhagic uterus, in which one has failed with curetting, the experiment may harmlessly precede removal to train one for actual cases where it is indicated. In the office it should be done, for such practice, at some time a few weeks before hysterectomy, so that the scar would have been formed and could be studied in section and it should not be done at such a brief time preceding operation that suppuration is under way at the time of removal.

Is there danger of the *cautery tip puncturing* the uterine wall? In experiments with a newly killed animal it is seen that as far as the intestinal wall goes there is not a great deal of difference between ten seconds and twenty seconds application of the heat. If five seconds application of the tip at a given heat will result in an eschar involving the whole mucous membrane, then twenty-five seconds is needed to produce perforation of the entire intestinal wall. This field of double the necessary exposure gives us a wide margin of safety. Moreover one takes care

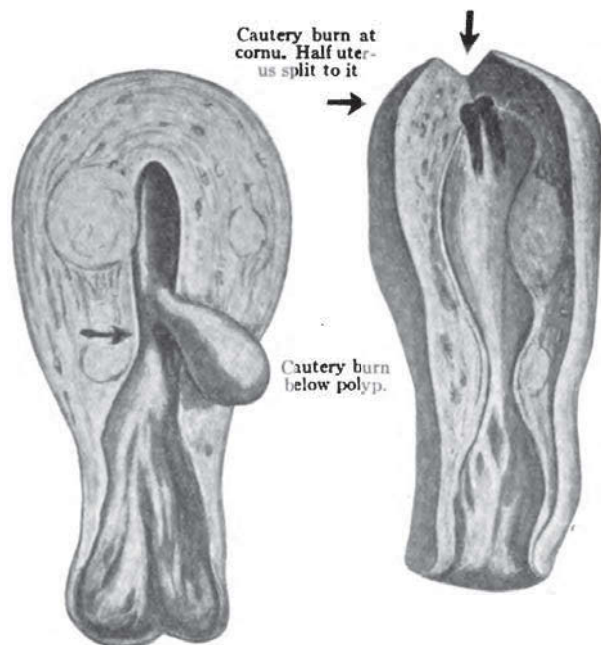


Fig. 7. Sketch of uterus in which the blunt or dome-tipped cautery-sound produced burns, preceding hysterectomy, as a demonstration of this method. Misapplied on one side—under polyp.

that no pressure is exerted in applying our heat and thus we further safeguard its application.

As shown by the researches of Hitchman and Adler, the mucous membrane of the uterine cavity is two or three times as thick during the six or seven days preceding the beginning of menstruation as during the resting stage. Therefore this is a time to be avoided. For three or four days after the cessation of menstruation, however, bleeding is so readily produced on contact that these days also should be avoided. The best time therefore will be from the seventh to the fourteenth day following the cessation of the flow.

CATHETERIZATION OF THE FALLOPIAN TUBES

W. Tyler Smith in 1849 speaks confidently of passing a fine whalebone guide through a silver directing tube which, fitting the curves of the cavity, leads the fishbone to the horn of the uterus and so beyond. "The fallopian angle of the uterine cavity is so acute, and the internal surface so smooth and dense in this situation that it is almost impossible for the whalebone fiber to miss the tube It is

necessary to have two silver tubes or catheters, one for the left, the other for the right" with "the curve of the uterine sound and an additional lateral curve at the extremity, turning toward the fallopian tube not as large as the uterine sound The bougie is very flexible at the extremity." Further study of this abandoned procedure is worth undertaking (Fig. 8).

STRICTURE BY CHEMICAL ACTION

The attempt to treat diseases of the endometrium and hæmorrhage by strong corrosive agents brought out a considerable literature in both French and German. The ultimate sweeping condemnation of the severer methods has an important bearing on our particular problem. Such destruction of the lining of the uterus occurred that obliteration of the cavity resulted, in part or in whole; or vicious stenosis followed, shutting off parts of the uterus and blocking up menstrual flow or suppressing it entirely. The reports demonstrate the power and effectiveness of these agents, which, hurtful in excess and when applied to a large area, may well do the work we require if properly limited and controlled. For instance Rielander (*Veil's Handbuch*, 226) did four hysterectomies 15 to 30 hours after chemical intra-uterine treatment (iodine, colloidal silver, formalin). The mucous membrane after 30 per cent formalin in alcoholic solution was sloughing in 24 hours, and after 50 per cent formalin in watery solution necrosed throughout, where cauterized. Crayons of 50 per cent zinc chlorid in the uterus, or the stick of fused silver nitrate left hours in the cervix — even with its thick lining — have produced complete obliteration. Of course such severe and painful measures thus applied are to be condemned. They may even lead to threatening hæmorrhage, from deep sloughing, as in the cases of Duehrssen and Duvelius. With these brief references to a large subject we pass on, merely drawing attention to the familiar partial closures of the vagina from cohesion of surfaces bared of their linings, and these in a canal subject to more motion than the uterine walls.

Froriep, in 1850, proposed a limitation of this chemical action in order thus to pro-

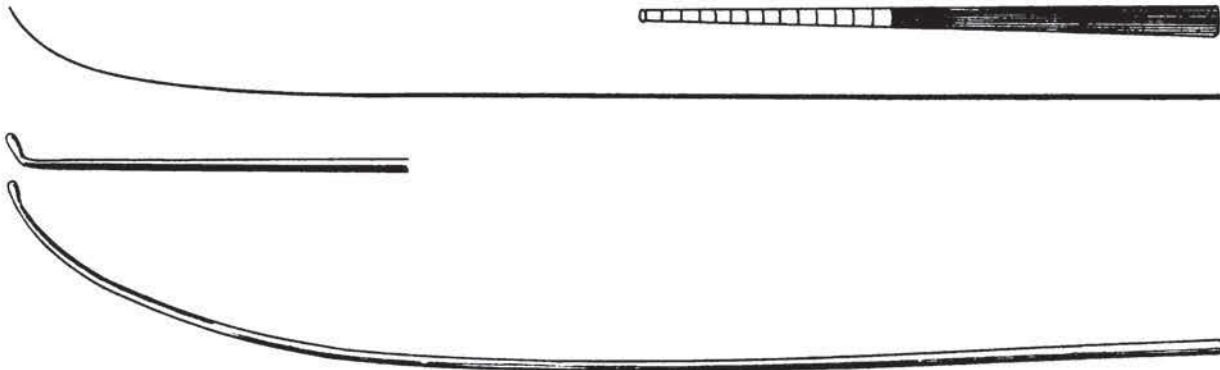


Fig. 8. Front and side views of the fallopian catheter. The first showing the uterovaginal curve; the second, the fallopian curve of the instrument. The other figures represent the whalebone bougie and the handle (scale unknown). (Tyler Smith.)

duce a limited slough and a stricture located in the tip of the horn of the uterus. He seems to have received little attention. The procedure consists herein: The speculum is introduced and "the conductor (Leitungsrohr) is passed through the os uteri up to the uterine opening of the tube and through this is pushed a sound tipped with nitrate of silver and so the circumference of the tubal opening is changed into a slough by deep cauterization." The same process is carried out on the other side, and "then the casting off of the two sloughs is watched."

"This casting off will take place (by analogy with cauterization of the bladder opening) in about 7 days, and there is the greatest possibility that, as no excretory flow keeps the way open, the complete adhesion (Verwachsung) has already occurred, as soon as the casting off of the slough has taken place. That the closure is perfect may be ascertained with sureness 8 days later by introducing the whalebone sound of Dr. Tyler Smith by which one may convince himself that the tubal lumen toward the uterus is passable. If this should be the case on one side, naturally the procedure must be repeated." He goes on to say that this cauterization is not dangerous, as it is the practice to produce such cauterizing with much deeper reaching injury to cure endometritis when the caustic agent must be applied through the speculum and when it is accomplished without consciousness on the part of the patient and many times without any marked reaction.

STRICTURE BY INTRA-UTERINE CAUTERY ELECTRODE

A method is submitted, simple and without danger, and heretofore only published by me in a discussion. It involves a moderate degree of gynecological dexterity and also some familiarity with the use of the electric cautery. It may be carried out in fifteen minutes in any office properly equipped.

The procedure consists in the production of a complete closure at the point where the fallopian tube enters the uterine cavity. The stricture is caused by scar shrinkage following the burn and the slough produced by the application of heat through a cautery tip the size of the point of the ordinary uterine sound on an instrument resembling a uterine sound, or by the use of the ordinary nasal electrode.

My evolution of this method has been as follows: Hunner has advocated the treatment of endotrachelitis by the use of the Paquelin tip. While simple and superficial involvements do best under silver salts or iodine, when one encounters a cervix chronically everted, eroded, and markedly granular, there is no method inducing such quick and permanent healing as the use of the heated wire. Take, for instance, the woman who has had one or two children and, as a result, has suffered considerable laceration of the cervix with subsequent outrolling and rawness. She desires other children. Meanwhile the cervix has to be put into order. If it is repaired or amputated subsequent

delivery will almost always tear it open again. Or there are cases in which the disease is on a sufficiently small area of the cervix so that, once healed, there would be no need of doing an inversion operation. The smallest sized tip that is used in the nose is applied in a point-puncture fashion or in longitudinal stripes, the burn going through the thickened mucous membrane. This may or may not have been preceded by the use of adrenalin novocaine applied to surfaces freed from all mucus. The method is a painful one without cocaine. One more successful use of this means in endotrachelitis I have developed; namely, in aggravated cervical catarrh. The cervical canal is solidly blocked with clear mucus, very tenacious and often large in quantity. In such cases one can spend several minutes in twisting strips of gauze into the canal before the half drachm of tenacious mucus has been entangled and is gradually withdrawn. Then we have a cavity which would hold the tip of the finger provided it could pass the narrowed external os. It had been my habit to treat these by scraping the gristly lining of this cervical canal with the small, sharp curette, which rasps as if on the back of Brussels carpet. If one fails under such conditions, the ordinary cautery wire tip of small size is laid along this area in stripes; or the tiny dome, its end the size of the ordinary uterine sound, is employed.

These matters have been developed in some detail because anyone who would carry out the method which I advocate in this paper would have an advantage in being accustomed to the use of the cautery under the above conditions, and would feel himself at home when this little dome or tip is slipped far out of sight up into the angle of the uterus. Previous experience shows just what heat will produce a given amount of slough.

DETAILS OF PROCEDURE

The steps are as follows: A suitable case is chosen. The patient has no submucous fibroid or cancer or any other disease which would necessitate a hysterectomy, or any disease which would necessitate opening the abdomen, for in either of these cases

hysterectomy or ligation of the tube would be clearly indicated rather than this method. Lying on the table with clothing loosened and bladder empty, in the lateroprone posture, and the Sims speculum in place, with the perfect illumination of the head light, or the forehead mirror, in a darkened room, a single tenaculum seizes the anterior lip of the cervix and steadies it. The canal being clean and open, 5 to 10 minims of novocaine (10 per cent) in adrenalin solution are injected through a Skene pipette and held under pressure a few seconds. Ten minutes are allowed for anæsthesia. Then the canal is wiped with Churchill's tincture or pure carbolic acid. Next the ordinary uterine sound, with the ordinary curve, and surely sterile, is passed into the uterus and to the fundus. It turns gently sidewise to outline the cavity of the uterus and find the cornu, and an exact note is made of the distance. We will say from the external os this is 2.5 inches. A clear mental picture is made of each cornu and the distance apart of the two angles. The sound is withdrawn. The cautery sound (which is of the same size) is bent to conform in shape to the uterine sound and has its slide pushed up until there is exposed exactly 2.5 inches of the farther end. This sound bears on its tip a little spiral or dulled point of platinum wire which will become incandescent. The switch is thrown and the platinum wire heated up as a test that it is working. Then against the cervical mucous membrane, in plain sight, the platinum tip is placed. The current is turned on. A count is made of the number of seconds required to burn into the tissues a sufficient distance to bury the platinum wire. This will then be the correct time, under ordinary circumstances, for the cornu. If the cervical tissue is dense from chronic inflammation a part of the vaginal wall may furnish the control test. It will have been previously bleached with novocaine-adrenalin. Now the tip is allowed to cool and this sound is passed into the uterus and finds the cornu as previously determined. Then the current is turned on for the number of seconds that have been found necessary to produce the burying effect at the cervix, care being taken

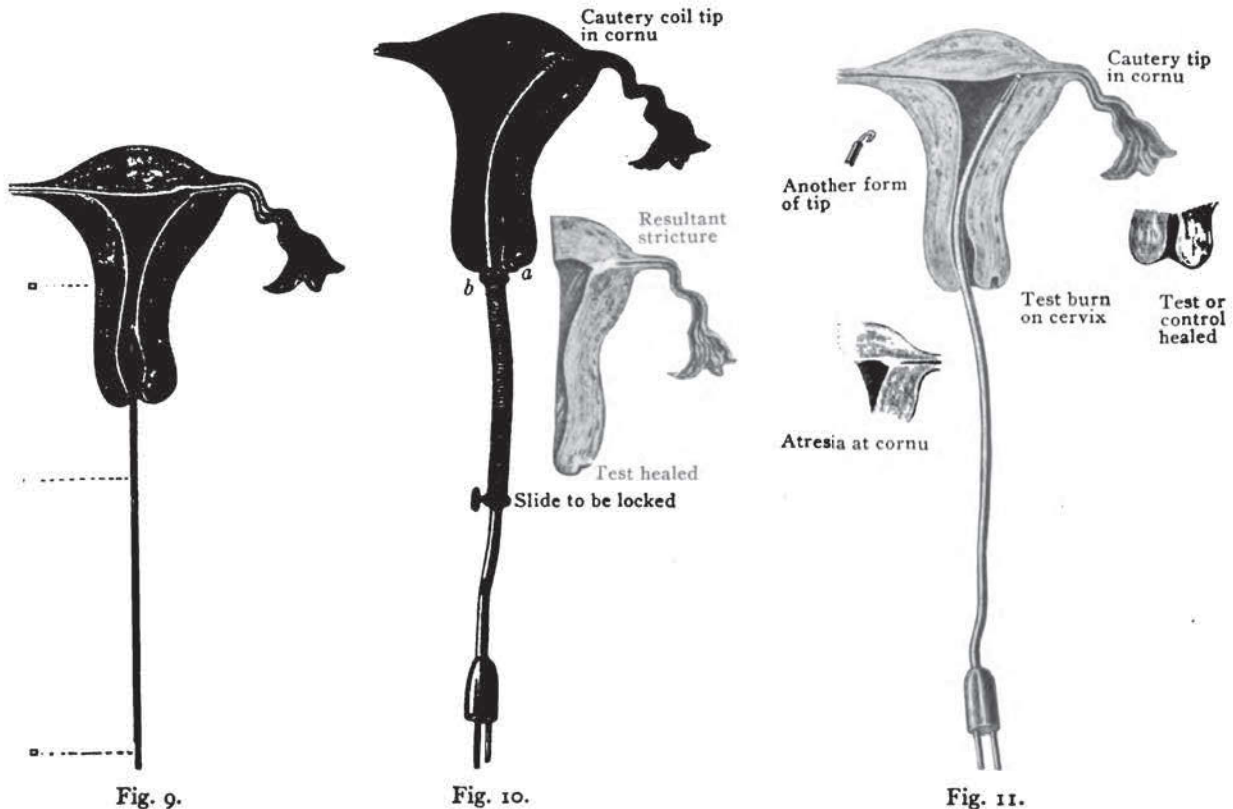


Fig. 9. Sterilization by chemical cauterization, showing metal or bent wood rod tipped with caustic. The rod may run in the catheter.
 Fig. 10. Sterilization by cauterity stricture with dome tip on uterine sound. This collar (b) prevents tip en-

tering beyond previously determined depth. (a) Test cauterity.
 Fig. 11. Sterilization by cauterity stricture with fine cauterity electrode.

to exert no pressure more than is necessary to hold the cauterity sound in place. The other cornu may be done at the same time or at a second session. The patient may lie down a bit or go home in some comfortable way and be quiet at home that afternoon and evening. If she has discomfort next day she should be quiet for that day and two or three thereafter. The reaction is usually no more than that of an ordinary intra-uterine application. A little bloody discharge may occur then or some days later, and the next period may be a little uncomfortable. There occurs on the cervix a slough and then a clean granulating wound that within two or three weeks is healed over. The cervix condition gives a guide to what is going on inside. At the end of three or four months the presence of a stricture and the closure of the tube may be ascertained by the X-ray method of William H. Cary of Brooklyn.

Strict indications must be worked out for each case. This goes without saying. The presence of physical conditions—like extreme deformity of the pelvis, or of disease, such as chronic Bright's, or of disability, such as idiocy, epilepsy or confirmed insanity or of criminality—these are presupposed. The more difficult decisions are in the case of women apparently permanently neurasthenic from severe labors or who have had to have several pregnancies interrupted. In any case written consents of husband and wife (or of the parents of an idiot) and signed agreements of physician and specialist should safeguard this measure.

Objections. The objections to cauterity stricture will probably lie in unskilled attempts. An insufficient cauterization will not produce atresia (complete closure). Adhesions of the uterine walls lower than the angle will do what the old chemical corrosives

did and may back up menstrual blood behind the spot acted on. Local hæmatometra or even hæmatosalpinx may result from such imperfect technique. By analogy with experimental ligatures of tubes on animals hydrosalpinx may follow this procedure even with tubes wide open at their flaring ends. Such hydrosalpinx has been of mild degree. The main trouble of course lies in the difficulty of knowing whether one has succeeded and whether assurance can be given so positively that the pair can omit contraceptive measures. Wherefore, until experience with removed uteri or freedom from pregnancy proves the procedure right we cannot be sure of it, unless, possibly, we can refine Tyler Smith's tubal catheter or perfect Cary's shadows.

In the case of defectives the simplicity of the procedure makes it worthy of trial even if we cannot guarantee all attempts.

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