OVULATORY FUNCTION AFTER MICROSURGICAL REVERSAL OF STERILIZATION IN THE RABBIT

A. PELLICER, F. BONILLA-MUSOLES

Department of Obstetrics and Gynecology
Medical School, Valencia (Spain)

SUMMARY

Twelve does were subjected to induction of ovulation and the ovulation sites were counted in each ovary after laparotomy and a section in the isthmus of each left tube was performed, followed by immediate microsurgical end-to-end anastomosis. All the right sides were subjected to sterilization at the isthmical portion of the tube. After three weeks rest, the animals underwent induction of ovulation, corpora lutea were counted and at this stage, reversibility of sterilization was carried out in the right tube. Three weeks later ovulation was again induced and the animals were killed. After overall evaluation and comparison of the results it can be affirmed that neither fine microsurgery or sterilization, nor refertilization in the isthmical part of the Fallopian tube interferes with the ovarian function.

Although the reversibility of sterilization in tubal surgery is the easiest procedure, its results are not as gratifying as one could expect. Some important factors to be taken into account when prognosis is to be made are: the presence of fimbriae ([12, 14, 15, 27]), the length of the tube ([17]) and the state of the mucosa, specially regarding its ciliar population ([30, 37]). Another factor which could also play an important role is the possibility that prior sterilization migh lead to an alteration of the ovarian function as Berger *et al.* ([3]) noted in 8 patients who asked for reversibility of sterilization.

A so called "post-tubal sterilization syndrome", characterized by menstrual irregularities and dismenorrhea has been extensively described ([2, 6, 19, 23, 28, 32, 33, 36, 39]) and analitically confirmed by the demonstration of a luteal insufficiency ([7, 9, 31]), although other Authors did not find it ([1, 5]).

It has also been demonstrated that it is specially the classical Pomeroy technique and the unipolar or bipolar coagulation that alter the function of the ovary ([7, 9, 31, 32]), while Hulka-Clemens clips ([7]) and endotermy ([16, 32]) do not produce these effects since the arterial supply in the ovary would not be disturbed when the uteroovarian artery is tied, which is supposed to be the cause of the problem ([7]).

Various experiments with animals studying the ovarian function after microsurgery in the different segments of the tube have been carried out, but none of them have described the effects of the reversibility of sterilization in tubes previously obstructed. This has been the purpose of our experimental work.

MATERIAL AND METHODS

Twelve New Zealand White does were subjected to several procedures (fig. 1) in both tubes. Each animal was isolated in an individual cage, fed properly and given twelve hours of light daily, the room remaining at a stable tem-

Clin. Exp. Obst. Gyn. - ISSN: 0390-6663
XI, n. 1-2, 1984

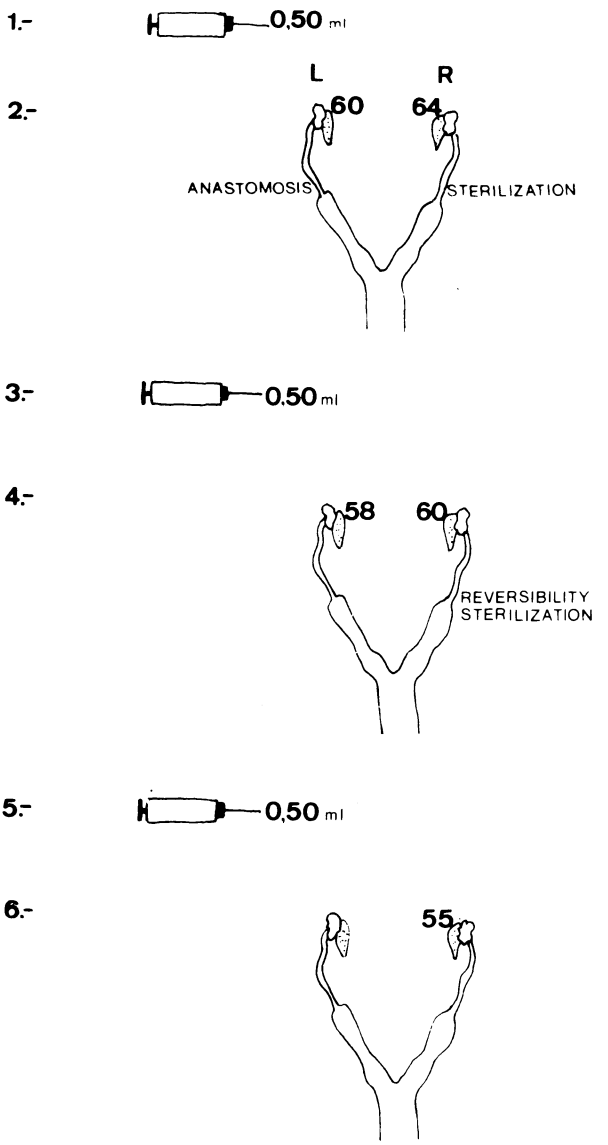
1.-
0,50 ml
2.-
L
R
60
64
ANASTOMOSIS
STERILIZATION
3.-
0,50 ml
4.-
58
60
REVERSIBILITY
STERILIZATION
5.-
0,50 ml
6.-
55

Fig. 1.

perature. One day before the operation they underwent a slight diet.

Each one received IM 0.5 ml of Gonadorelin (Fertagyl®) as an inductor of ovulation and 12 hours later a medial laparotomy was performed for exposure of both oviducts and ovaries, after general anesthesia induced with Penthobarbital (Nembutal®) (30 mgs/kg of body weight). The ovulation sites were counted in each ovary and a section in the isthmus of each left tube was systematically performed, followed by immediate end-to-end anastomosis with four or five muscular sutures and six to nine serosal sutures of 10/0 Nylon (Ethilon®). All the right sides were systematically subjected to sterilization at the isthmical portion of the tube including a length between 1 and 1.5 mm. 7 cases were carried out with catgut ligature and 5 with bipolar coagulation.

After three weeks' rest, the animals underwent an injection of 0.5 ml of Gonadorelin, and after laparotomy the corpora lutea were counted on both sides and, at this stage, reversibility of sterilization was carried out in the right tubes previously obstructed.

Three weeks later ovulation was again induced and after twelve hours, the animals were killed in order to observe the ovarian function after reversibility of sterilization. The corpora lutea in the right side were counted and the statistical study was carried out following the Wilcoxon test.

RESULTS

After overall evaluation and comparison of the data and results obtained we osberved that after induction of ovulation, there were 60 corpora lutea (fig. 1) in the left ovary, and after microsurgery there were 58 ($p=0.7$). This difference not being significant at all, it can be asserted that fine microsurgery in the isthmical portion of the tube does not disturb the ovarian function.

As for the right side, the number of corpora lutea obtained after induction of ovulation before surgery was compared to that obtained after sterilization and later refertilization (fig. 1). The former amount was 64 corpora lutea, which decreased to 60 ($p = 0.37$) after sterilization by bipolar coagulation or ligature. After refertilization, the amount of corpora lutea was 55 which is insignificant either compared to the amount obtained before sterilization ($p = 0.215$) or that obtained after it ($p = 0.37$).

Therefore it can be affirmed that neither sterilization, nor refertilization in the isthmical portion of the Fallopian Tube interferes with the ovarian function in our experimental model.

DISCUSSION

Microsurgery has implied an important development in the field of reversibility of sterilization as, while the rates of pregnancy with conventional surgical techniques did not surpass 10% of the cases operated, and the Authors were glad when rates of 25% were achieved ([11, 34, 40]), the present statistics of most Authors using microsurgery goes over 60% ([21]).

There are, however, a series of morphological and technical factors which clearly affect the results. The first and most important of all is perhaps the presence of ciliae in the mucosa. It has been demonstrated ([30]) that the presence of at least 61% of the ciliar population is necessary for the tubes to carry out their physiological function of ovular transport, and that sterilization eventually produces a series of morphological changes like a flattening of the mucosal folds, a decrease in the number of ciliae and the presence of tubal polyps ([37]).

A second factor is the tubal length after surgery which is related to the successful rate ([10, 25, 35]), the longer the tube is the more pregnancies can be obtained, the ideal length being 6 cm or more, although pregnancies with less than 2 cm of tube have also been achieved ([18]). Also, the place where anastomosis is performed plays an important role, the most favourable zone seeming to be the isthmical portion or the isthmical-ampullary junction ([10]).

The presence of fimbriae seems to be also important, a prior fimbriectomy being

considered by some surgeons as a contraindication for reversibility of sterilization. Nevertheless, in animal experiments the results are contradictory; while Halbert *et al.* ([14, 15]) and Metz and Mastroianni ([27]) confer to fimbriae an important role, Beyth and Winston ([4]) performed a unilateral microsurgical fimbriectomy with removal of ovarian fimbria in 19 rabbits, forming a racket-like neostomy which was capable of free movement over the ovarian surface. They did not find differences in the nidation index between the side operated and the controlateral side which was intact and served as a control.

Berger *et al.* ([3]) studied the Progesterone rates in 10 patients who requested reversibility of sterilization, finding lower values than those in a control group, and so suggesting the possibility of an ovarian deficiency after sterilization. This fact was later confirmed by other Authors([7, 9, 17, 31]) although others did not find significant statistical differences with the control groups ([1, 5, 16, 19]). The kind of sterilization is also worth taking into account: it seems that uni or bipolar coagulation and ligature affect ovulation somehow ([7, 9, 31]), while endothermy and Hulka-Clemens clips would not affect it at all ([7, 16, 32]).

The possible cause of this ovarian alteration after coagulation or ligature would be the obstruction of the utero-ovarian artery which would produce a defect in the corpus luteum supply and, consequently, an insufficient hormonal production. This hypothesis is supported by animal experiments which demonstrated changes in the ovarian vascular flow when the ovulatory follicle and corpus luteum are present ([29]), although an alteration of the ovarian function after hysterectomy has not been confirmed in human beings ([5, 8]) in spite of the disturbance in the vascular flows caused by this operation. In animal experiments an increase in the oxygen tension after ovulation has also been proved in the oviduct where the ovulation has taken place ([24]).

The probable corpus luteum insufficiency after sterilization could be the cause of surgery failure. In order to solve this problem we proposed an animal model to evaluate the effect of sterilization in ovulation, and an eventual recuperation after surgery if the corpus luteum function had been altered. The effect of microsurgery was only evaluated in the isthmical part of the controlateral tube, since if anomalies after reversibility of sterilization had been found in the other side, they could also have been caused by microsurgery, and we had to discard this possibility.

Our results confirm that there is no influence of the fine and atraumatic surgery in the ovarian function in the isthmus, as other Authors had already proved ([13, 26, 38]). Some differences have been found, but only in ampullo-ampullar or isthmo-ampullar anastomosis ([22]) and in fimbrio-ampullar recessions ([26]), although neither the former ([38]) nor the latter ([4]) has been confirmed by other Authors.

There are no differences between the ovarian function before sterilization by ligature or coagulation and after it ($p = 0{,}37$). The fact that only 7 rabbits were sterilized by Pomeroy and 5 by coagulation did not allow the data in each method to be treated separately for statistical purposes, but, as a reference, we can give the following figures: in the seven cases of ligature 43 corporea lutea were found before operation and 36 after it, while in the group of bipolar coagulation 21 before and 24 after operation were counted.

The number of corpora lutea found after refertilization was not statistically significant either compared to the number found before sterilization or after it, this indicating that fine microsurgery after obstruction of the tube does not interfere with the ovarian function.

We also think that there is not significant nervous or vascular alteration in the ovary and, even with little damage in the isthmus, its function remains completely

unaltered; hence pregnancies may occur within the first post-operative months as has been stated by other Authors ([13]).

BIBLIOGRAPHY

1) Alvarez-Sanchez F., Segal S. J., Brache V., Adejuwon C. A., Leon P., Faundes A.: *Fertil. Steril., 36*, 606, 1981.
2) Baggish M. S., Lee W. K., Miro S. J., Dacko L., Cohen G.: *Obst. Gyn., 54*, 54, 1979.
3) Berger G. S., Radwanska E., Hammond J. E.: *Am. J. Obst. Gyn., 132*, 699, 1978.
4) Beyth Y., Winston R. M. L.: *Fertil. Steril., 35*, 464, 1981.
5) Corson S. L., Levinson C. J.: *J. Reprod. Med., 26*, 363, 1981.
6) Chamberlain G., Foulkes J.: *South. Med. J., 69*, 1474, 1976.
7) Donnez J., Wauters M., Thomas K.: *Obst. Gyn., 57*, 65, 1981.
8) Doyle L. L., Barclay D. L., Duncan G. W., Kirton K. T.: *Am. J. Obst. Gyn., 110*, 92, 1971.
9) Eibschitz I., Samberg I., Oettinger M., Degani S., Shappiro I., Sharf M.: *Int. J. Fertil., 28*, 38, 1983.
10) Frantzen C. H., Schlösser H. W., Albrecht H., Dolff M.: *Mikrochirurgische Korrekturmöglichkeiten der ungewollten tubaren Sterilität. Erfahrungen und Ergebnisse an über 500 Eileiteroperationen.* 44 Tagung Deutsche Gesellschaft für Gynäkologie und Geburtshilfe, München, 13.-17.9.1982.
11) Garcia C. R.: *Surgical reconstruction of the oviduct in the infertile patient.* In: *Progress in infertility*, Behrman S. J., Kistner R. W. (eds.), Boston, Little Brown, p. 255, 1968.
12) Gomel V.: *Clinical results of infertility microsurgery.* In: *Microsurgery in female infertility*, Crosignani P.G., Rubin B.L. (eds.), Academic Press, London, p. 77, 1980.
13) Gomel V., McComb P., Halbert S.: *Fertil. Steril., 37*, Abstr., Suppl., 294, 1982.
14) Halbert S. A., McComb P.: *Fertil. Steril., 35*, 355, 1981.
15) Halbert S. A., Patton D. L.: *Fertil. Steril., 35*, 349, 1981.
16) Helm G., Sjöberg N. O.: *Int. J. Fertil., 28*, 38, 1983.
17) Henderson S. R.: *Am. J. Obst. Gyn., 139*, 73, 1981.
18) Hochuli E.: *Perspektiven verschiedener mikrochirurgischer Techniken. 154 Tagung.* 80 Jahre Mittelrheinische Gesellschaft für Geburtshilfe und Gynäkologie, Kassel, 26.-27. 6.1982.
19) Hulka J. F.: *Int. J. Fertil., 28*, 39, 1983.
20) Hulka J. F., Marik J.: *Fertil. Steril., 29*, 270, 1978.
21) Inthraphuvasak J., Pellicer A.: *Rev. Esp. Obst. Ginec., 41*, 585, 1982.
22) Koninckx P. R., Boeckx W. D., Verhoeven H. C., Winston R. M. L., Brosens I. A.: *Infertility, 3*, 85, 1980.
23) Lawson S., Cole R. A., Templeton A. A.: *Br. J. Obst. Gyn.*, 659, 1979.
24) Maas D. H. A., Storey B. T., Mastroianni L. Jr.: *Fertil. Steril., 27*, 1312, 1976.
25) McComb P., Gomel V.: *Fertil Steril., 31*, 673, 1979.
26) McComb P., Bourdage R. J., Halbert S. A.: *Fertil. Steril., 35*, 481, 1981.
27) Metz K. G. P., Mastroianni L. Jr.: *Fertil. Steril., 32*, 329, 1979.
28) Neil J. R., Hammon G. T., Noble A. D., Rushton L., Letchworht A. T.: *Lancet, 2*, 699, 1975.
29) Niswander G. D., Akbar A. M., Nett T. M.: *The role of blood flow regulating ovarian function. The endocrine function of the human ovary.* Proceedings of the Serono Symposium, Vol. 7, James U. H. T., Serio M., Guisti G. (eds.), London, Academic Press (1976).
30) Odor L., Blandau R. J.: *Fertil. Steril., 24*, 292, 1973.
31) Radwanska E., Berger G. S., Hammond J.: *Obst. Gyn., 54*, 189, 1979.
32) Riedel H. H., Semm K.: *Int. J. Fertil., 28*, 40, 1983.
33) Rubinstein L. M., Lebherz T. B., Kleinkopf V.: *Contraception, 13*, 631, 1976.
34) Siegler A. M., Perez R. J.: *Fertil. Steril., 126*, 383, 1975.
35) Silber S. J., Cohen R.: *Fertil. Steril., 33*, 598, 1980.
36) Stock R. J.: *Int. J. Fertil., 28*, 41, 1983.
37) Vasquez G., Boeckx W., Winston R., Brosens I.: *Human tubal mucosa and reconstructive microsurgery.* In: *Microsurgery in female infertility.* Crosignani P. G., Rubin B. L. (eds.), Academic Press, London, p. 41, 1980.
38) Verhoeven H. C., Lott D., Reichman J.: *Am. J. Obst. Gyn., 143*, 835, 1982.
39) Whitelaw R. G.: *Br. Med. J., 1*, 32, 1979.
40) Williams E. A.: *Br. Med. J., 1*, 599, 1973.