

# Ovarian Function in Rats Following Bilateral Salpingectomy and Tubal Ligation

## RATLARDA BİLATERAL SALPENJEKTOMİ VE TUBAL LİGASYONU TAKİBEN OVER FONKSİYONU

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### Abstract

**Objective:** We studied whether bilateral salpingectomy and tubal ligation would have adverse effects on ovarian function, in a rat model.

**Material and Methods:** Forty-eight female Whistar albino rats which were divided equally into three groups underwent laparotomy, while no specific intervention was made to the first group. Bilateral tubal ligation by Pomeroy's technique, bilateral salpingectomy was done to the second and third groups, respectively. All rats were then individually caged and fed on demand. Three months after surgery, the rats were sacrificed and underwent bilateral oophorectomy. A pathologist blinded to the groups made histological examination by counting number of healthy tertiary follicles and corpora lutea in each ovary. The results of the groups were statistically compared by Student's t-test and Fischer chi square test.

**Results:** Rats in group 1 had significantly higher number of healthy tertiary follicles and corpora lutea than every other group.

**Conclusion:** Our findings suggest that salpingectomy and tubal ligation procedures may affect subsequent ovulatory function in rats.

**Key Words:** Salpingectomy, tubal ligation, ovarian function

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### Özet

**Amaç:** Bilateral salpenjektomi ve tubal ligasyonun over fonksiyonu üzerine bir yan etkisinin olup olmadığını bir rat modelinde inceledik.

**Gereç ve Yöntemler:** Kırksekiz adet dişi Whistar Albino rat eşit şekilde ayrılarak laparotomi yapıldı. İlk gruba spesifik bir girişim yapılmadı. İkinci ve üçüncü gruba sırasıyla Pomeroy tekniği ile tubal ligasyon ve bilateral salpinjektomi uygulandı. Tüm ratlar bireysel olarak kafes içinde beslendi. Cerrahiden üç ay sonra tüm ratlar öldürülerek bilateral ooforektomi uygulandı. Gruplara kör, bir patoloğ her bir overdeki sağlıklı tersiyer folikülleri ve korpus luteumları sayarak histolojik incelemeyi yaptı. Grupların sonuçları istatistiksel olarak Student's t testi ve Fischer ki kare testi ile karşılaştırıldı.

**Bulgular:** İlk gruptaki ratların sağlıklı tersiyer folikülleri ve korpus luteumları diğer iki gruptan belirgin şekilde daha fazlaydı.

**Sonuç:** Bulgularımız ratlarda, salpenjektomi ve tubal ligasyon işlemlerinin over fonksiyonunu etkileyebileceğini göstermiştir.

**Anahtar Kelimeler:** Salpinjektomi, tubal ligasyon, over fonksiyonu

Female tubal sterilization has been practiced for years as an effective contraceptive method.<sup>1</sup>

The effect of sterilization on ovarian function has been investigated for a long time. Some studies investigated this effect in terms of menstrual disorders,<sup>2,3</sup> whereas others assessed ovarian function by means of hormonal assays.<sup>4-7</sup>

Salpingectomy is also a common established procedure for benign disorders like ectopic pregnancy, hydrosalpinx, pyosalpinx etc which may also have a detrimental effect on the ovarian arterial supply.<sup>8,9</sup> To our knowledge, there are no reports available comparing the bilateral tubal sterilization and salpingectomy on the ovarian function.

In this study, we aimed to analyze the short-term effects of sterilization and bilateral salpingectomy.

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**Table 1.** Number of healthy tertiary follicles and corporea lutea per rat in the sham-operated, tubal ligated and salpingectomized groups

Group	Follicles (per rat)	p	Corpora lutea (per rat)	P
1 Sham-operated (n=16)	11.1±6.4	-	9.3±5.4	-
2 Tubal ligated (n=13)	4.2±1.7	0,002	6.7±2.6	0.003
3 Salpingectomized (n=12)	3.9±1.1	<0.001	5.6±2.5	0,002

Values are given as mean ± SD.

tomy on ovarian function by means of ovarian histology, in a rat model.

### Material and Methods

This research protocol which was in compliance with the universal guide for the care and use of laboratory animals was approved by the Animal Care and Use Committee of Akdeniz University. Forty eight female Wistar-albino rats, each weighing 200-250g and 2-3 months old, were used for the study. The rats were housed in wire cages, maintained at 22,2±1.7 C on a 12 h light, 12 h dark cycle and had access to food [TekVad Diet, TD89222 (0.5% calcium and 0.4% phosphorus), Tek Vad Madison, WI] and water ad libitum.

The rats were divided equally into three groups. The rats were then prepared for surgery and anesthetized with intraperitoneal injection of 40 mg/kg ketamine HCL and xylazine HCl 50 mg/kg, abdominal skin was shaved and antisepsis was obtained by 10% povidone iodine solution. Through a low midline vertical incision, no special intervention was made to the first group, whereas a bilateral salpingectomy and a bilateral tubal ligation by Pomeroy's technique surgically 1cm away from both uterine horns were performed with the use of atraumatic microsurgical techniques using 2/0 silk in the second and third groups. Peritoneal cavity was then closed en bloc with 2/0 catgut. Abdominal skin was closed en bloc with 2/0 silk. The total duration of laparotomy was 10 min for every individual rat, including the ones in the first group. The rats were observed for 3 months, and then sacrificed in estrus phase of the menstrual cycle for removal of the ovaries. A pathologist blinded to the groups performed the histological

examination of ovaries, by counting the healthy tertiary follicles and all of the corporea lutea in each ovary. Total number of follicles and corporea lutea were recorded individually for each rat.

Statistical analysis was performed with the use of student's t-test and Fischer chi square test. P values of less than 0.05 were taken as indicating a significant difference.

### Results

Average numbers of follicles and corporea lutea in each group are listed in Table 1. No other specific histologic finding was noticed in the ovaries. One animal from each group died postoperatively. In seven animals from tubal ligated and salpingectomized groups, only one ovary each could be visualized, because of periovarian adhesions. This altered the numbers in the two groups to 13 and 12, respectively.

Rats in the control group (group 1) had significantly higher number of tertiary follicles and corporea lutea than every other group (P <0.005) (Table 1, Figure 1-3)

### Discussion

There are numerous reports regarding the effects of female sterilization and salpingectomy on ovarian function indicating a significant decrease in the number of tertiary follicles.<sup>9,10</sup> However there are also reports indicating the lack of correlation, one of which is the only study denying such a relation in an animal model.<sup>11</sup>

Beyth and Winston performed microsurgical fimbriectomy in rabbits and observed fewer ovulations on the operated side.<sup>12</sup> Mc Comb and Del-

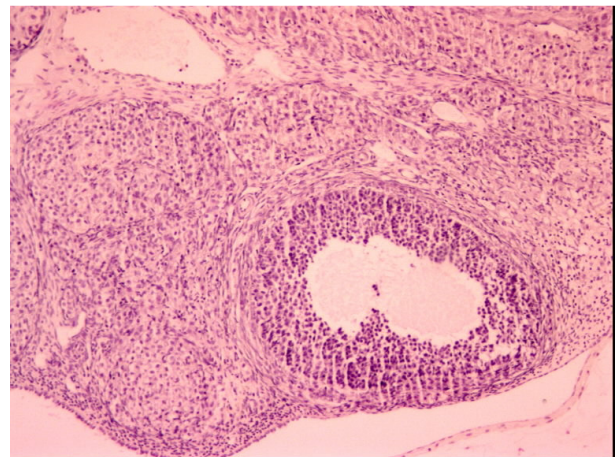
beke described the effects of surgical division of the anastomotic blood vessels between the ovary and fimbriae on the number of ovulations in that ovary in rats.<sup>13</sup> They found a significant reduction in the number of ovulations in that ovary when compared with the contralateral control ovary in the same animal, also suggesting the importance of preserving the tuboovarian blood supply. Zhao et al also studied the effects of salpingectomy on ovarian function in monkeys and found no difference in progesterone levels between the study and control groups before and after the operation.<sup>14</sup>

Lass et al studied the effect of salpingectomy on ovarian response to superovulation.<sup>15</sup> Significantly fewer follicles developed and consequently fewer oocytes retrieved from the operated side compared with the intact adnexa, indicating a degree of blood flow impairment to the ovary.<sup>15</sup>

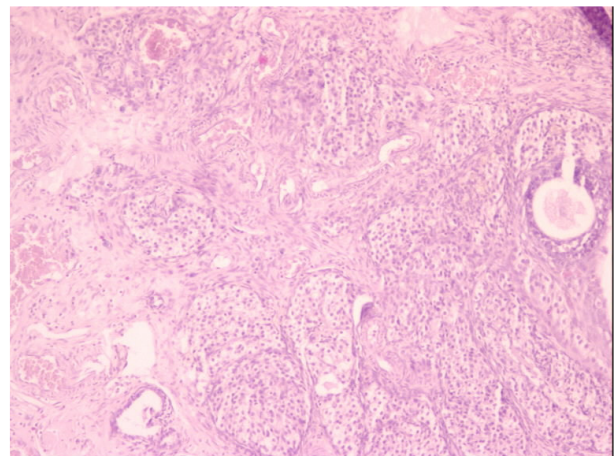
The results of our study indicate a correlation between sterilization, salpingectomy and ovarian histology in rats. The median number of healthy tertiary follicles per rat was significantly reduced when compared with sham-operated controls. This reduction in the number of healthy tertiary follicles may be explained by the disruption in the normal blood flow to the ovary, which may further have a negative impact on steroid production and diminished ovarian reserve. The medial tubal artery is the most important blood supply to the tube, has its origin at the same point as the median ovarian artery. If the salpingectomy or tubal sterilization is not properly performed close to the tube, ovarian blood flow may also be disrupted.

Although any gross change in uterine or ovarian arterial flow has not been reported by Doppler flowmetry following sterilization in humans,<sup>16</sup> microvascular perfusion changes may occur in ovarian blood flow, as is shown for endometrium.<sup>17</sup> Such a reduction in ovarian perfusion may decrease ovarian reserve in rats, in medium to long-term, resulting in a diminished number of tertiary follicles and corpora lutea.

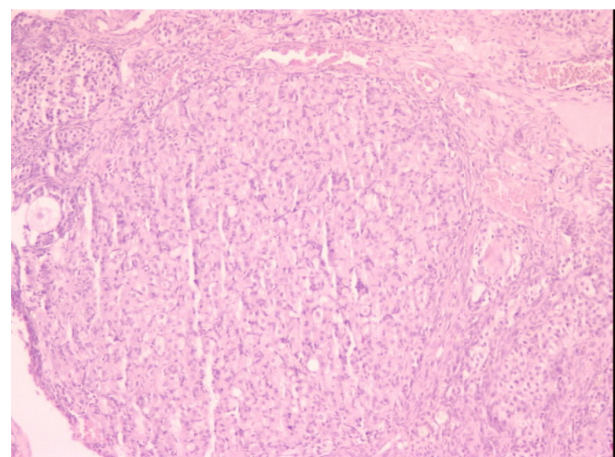
The rat model may not be an ideal model to study the possible effects of sterilization and sal-



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**Figure 1.** Ovarian section stained with hematoxyline eosin in X100 magnification with light microscope in the a) sham operated b) tubal ligated and c) salpingectomized rats.

pengectomy on ovarian function in humans because of the differences that exist between two species regarding reproductive physiology. As a result we may conclude that salpengectomy as well as tubal ligation have detrimental effects on ovarian function in rats. Further investigations are needed to explain the possible mechanisms for reduced ovarian reserve and to draw back further conclusions.

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