



Clinical management controversy caused by a rare case of silver clip detachment and displacement after tubal silver clip sterilization

Chunyan Zheng, MD^a, Guangxing Wu, MD^b, Linli Wu, MSc^c, Yaqin Zheng, MD^d, Zijun Li, PhD^{a,*}

Introduction and importance: The treatment of rare long-term complications such as ectopic silver clips after tubal silver clip sterilization, still follows the principle of removing metal foreign body (MFB) in the abdominal cavity: first choice removal, which seems to be a habitual treatment method by clinical gynecologists. However, this measure has recently been greatly questioned.

Case presentation: A 54-year-old postmenopausal woman who had undergone tubal sterilization with a silver clip 32 years ago, presented to the emergency department (ED) with severe left upper abdominal colic, paroxysmal, accompanied by vomiting and radiating pain. Her vital signs were stable, and an emergency routine urine test showed microscopic hematuria. Preliminary consideration was given to ureteral stones, and abdominal pain was relieved after treatment. Abdominal computed tomography confirmed the previous consideration, but unexpectedly found that the left tubal sterilization metal clip disappeared and was ectopic in the perihepatic space.

Clinical discussion: This traditional conception of removing MFB in the abdominal cavity is often accepted by many surgeons. Based on the management measures of this case and the systematic review of the literature, we found that the detached ectopic silver clip did not cause serious long-term complications, possibly due to its good tissue receptivity and other characteristics.

Conclusion: Although an ectopic silver clip is an MFB in the abdominal cavity, it has been increasingly shown that removing the silver clip is not necessary because of the good receptivity of silver to human tissue and the uncertainty of long-term side effects on the human body.

Keywords: ectopic silver clip, metal foreign body, removal, tubal sterilization

Introduction and importance

Since Evans first reported the use of silver clips for tubal sterilization^[1], they have received attention from many countries' family planning programs, especially in China^[2]. Given China's national family planning policy, as early as the 1970s, many clinical family planning workers in China were very enthusiastic about the clinical research and practice of fallopian tube silver clip sterilization^[2,3]. According to reports, the silver-clip

HIGHLIGHTS

- The first systematic review and analysis of the long-term complications after tubal silver clip sterilization: detachment and displacement of the sterilization silver clip.
- The first question was raised about whether the dislodged silver clip from fallopian tube sterilization had been removed.
- It is not necessary to routinely remove the dislocated silver clip for the first time, and long-term follow-up may be possible after fully informing the patient and her family.

^aDepartment of Gynecology, Longquan People's Hospital affiliated to Lishui University, ^bClinical Imaging Diagnosis Center, Longquan People's Hospital affiliated to Lishui University, ^cNursing Department, Longquan People's Hospital affiliated to Lishui University and ^dClinical Laboratory Centre of Longquan People's Hospital affiliated to Lishui University, Longquan City, Zhejiang Province, People's Republic of China

Sponsorships or competing interests that may be relevant to content are disclosed at the end of this article.

*Corresponding author. Address: Department of Gynecology of Longquan People's Hospital affiliated to Lishui University, No. 699 of Dongcha Lane, Longquan City 323700, Zhejiang Province, People's Republic of China. Tel.: +86 182 689 392 62. E-mail: lizjunclark@126.com (Z. Li).

Copyright © 2024 The Author(s). Published by Wolters Kluwer Health, Inc. This is an open access article distributed under the terms of the Creative Commons Attribution-Non Commercial-No Derivatives License 4.0 (CCBY-NC-ND), where it is permissible to download and share the work provided it is properly cited. The work cannot be changed in any way or used commercially without permission from the journal.

Annals of Medicine & Surgery (2024) 86:5513–5517

Received 27 April 2024; Accepted 20 June 2024

Published online 17 July 2024

<http://dx.doi.org/10.1097/MS9.0000000000002367>

sterilization technique for fallopian tubes has undergone five generations of updates and improvements^[3]. It has been confirmed that tubal clamp sterilization is a safe, effective, and highly reversible contraceptive method^[2,4]. This indicates that the recent complications of tubal silver clips are negligible^[3]. However, there is little research on the long-term complications of tubal silver-clip sterilization, and complications of silver clip detachment and displacement have rarely been reported^[5]. Here, we report a rare case of a postmenopausal woman with a silver clip dislodged and ectopic to the abdominal cavity who underwent fallopian tube silver clip sterilization 32 years ago. However, further treatment for the detached and displaced fallopian tube sterilization of silver clips has sparked a controversy among different opinions. Therefore, we also systematically reviewed and analyzed how to further handle the ectopic tubal silver clip in the reported relevant literature, to provide clinical guidance.

This case report has been reported in line with the SCARE criteria 2023^[6].

Case presentation

A 54-year-old postmenopausal woman was brought to our emergency department (ED) with acute abdominal pain. The past medical and surgical history was non-specific, except for a history of fallopian tube sterilization. The patient confirmed that she had undergone tubal sterilization with a silver clip 32 years ago previously. It had not occurred that there were any obvious discomfort or unexpected pregnancy events, no obvious lower abdominal pain, and no history of menstrual disorders after tubal sterilization with a silver clip. The patient had been menopausal for 4 years, with no special abdominal symptoms after menopause.

On arrival at the ED, the patient presented with typical severe left upper abdominal colic, paroxysmal, accompanied by malignant vomiting and radiating pain in the perineal area. Physical examination revealed a clear mind, painful face, and no abnormalities in the heart and lungs. She had a temperature of 37.0, blood pressure of 100/70 mmHg, respiratory rate of 16/min, and pulse rate of 85/min. An emergency routine urine test showed microscopic hematuria (Fig. 1). Subsequently, a full abdominal computed tomography scan showed left ureteral stones accompanied by upper urinary tract dilation (Fig. 2), and consideration was given to the displacement of the left fallopian tube metal contraceptive clip in the perihepatic space was considered (Fig. 3). In view of the above, a preliminary diagnosis of ureteral stones was made, and immediate spasmolysis and analgesic treatment were administered. Subsequently, the patient's symptoms and signs were completely relieved, and she came to the gynecological clinic for further treatment after 2 weeks of non-surgical stone removal treatment. However, there have been significant disagreements among gynecologists regarding the further treatment of ectopic silver clips after tubal sterilization. One view suggests that active treatment should be performed according to the principles of intra-abdominal metal foreign body (MFB), and laparoscopic removal of a dislodged

silver clip should be performed first. Another viewpoint suggests that the silver clip for tubal sterilization is originally located in the pelvic cavity but has only fallen off and shifted without the need for further surgical removal. It is only recommended that close follow-up is performed every 3 months.

Finally, after careful communication with the patient and their family, the patient and their family chose to temporarily abandon surgical treatment and accepted a further long-term follow-up plan.

Clinical discussion

Intra-abdominal MFB is a relatively rare clinical phenomenon and complication. Generally, two types of intra-abdominal MFBs are generated by iatrogenic factors and traumatic factors. The former is often more serious, while the residual MFB in the abdominal cavity caused by surgical errors is one of the most fatal medical accidents, often leading to high medical compensation and the most severe medical administrative penalties^[7,8]. In addition, the expected implantation of MFB for the treatment of some diseases, such as metal vascular clip (titanium clip, silver clip, tantalum clip, etc.), is often seen in various surgical procedures, especially in hemostatic treatment, and the introduction of various metal clip hemostatic instruments has made it convenient, fast, and significantly improved the effectiveness of intraoperative hemostasis^[9-11]. The MFB involved in this case was a therapeutic iatrogenic MFB caused by tubal silver clip sterilization surgery.

Silver clip sterilization of fallopian tubes is a safe, simple, effective, and highly reversible method of tubal sterilization^[3,4]. It was first proposed by Evans in the early 1950s^[1] and introduced to China in the 1970s. It became popular in the 1990s and has undergone multiple updates and improvements. The first generation of silver clips from the 1980s to the fifth generation of silver clips from the 1990s, until the recent clinical application of the modified sterilization silver clip (mYZ-II)^[3], were respectively produced in Hubei, Shandong, Hebei, and Guangdong provinces in China^[2]. To date, research on the complications of fallopian tube silver clip sterilization has been more limited to recent complications such as contraceptive failure caused by metal clip

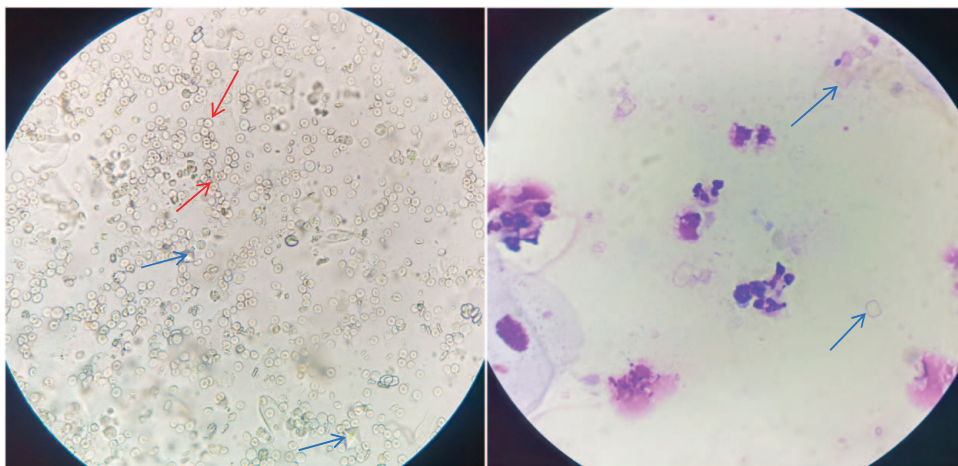


Figure 1. Microscopic hematuria: a large number of double concave disc-shaped red blood cells (red arrows) and calcium oxalate crystals (blue arrows) can be seen covering the field of view under the light microscope. Calcium oxalate crystals are shown as envelope-shaped and polygonal crystals (green arrows) under Wright-Giemsa staining (magnification = 10 × 40).

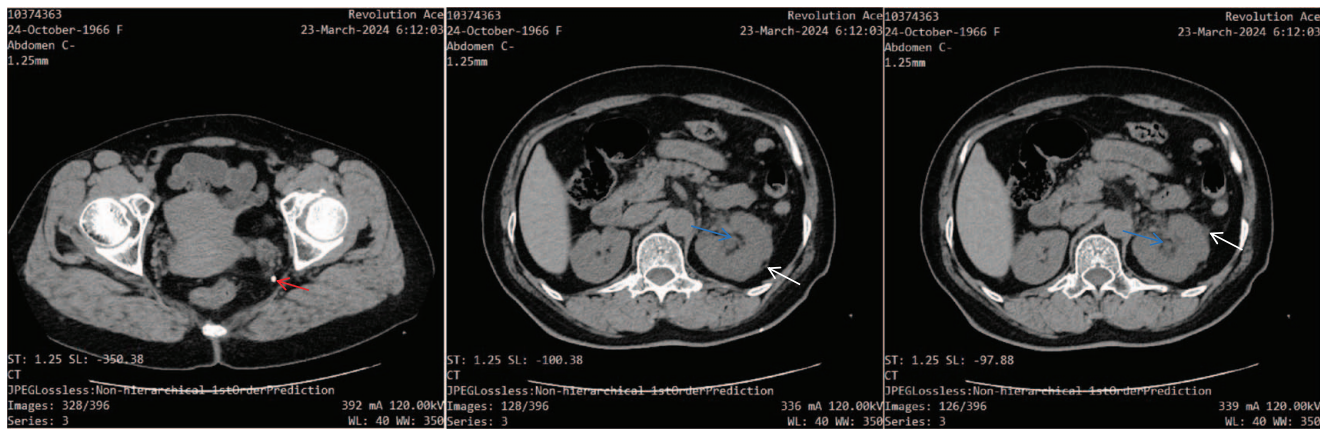


Figure 2. Computed tomography imaging of left ureteral stones: At the junction of the left ureter and bladder (inner wall segment), there is a calcified stone lesion (red arrow), accompanied by ureteral dilation, renal collection system dilation (blue arrows), and renal enlargement with perirenal exudation (white arrows).

detachment and displacement^[3], uncertain menstrual disorders^[12], and unexplained chronic pelvic pain^[3,4]. However, there have been few studies on the long-term complications caused by the detachment and displacement of tubal sterilization silver clips, such as erosion and perforation of hollow organs, chronic corrosion and damage to substantial organs, and possible systemic toxic reactions caused by metal silver clips. This has caused great controversy and disagreement regarding the disposal of ectopic silver clips.

In theory, detached and displaced tubal sterilization silver clips may pose potential risks and toxic effects on the human body. As is well known, intrauterine devices located outside the abdominal cavity can cause serious complications such as sigmoid perforation^[13,14], secondary abdominal infection^[14], and bladder perforation^[15]. Therefore, there is no doubt that such intra-abdominal MFBs must be removed. Wei *et al.*^[16] had collected 26 cases of patients with silver clip dislodgement and displacement after tubal silver clip sterilization surgery and confirmed 15 cases of left displacement (57.70%), 5 cases of right displacement

(19.20%), and 6 cases of both left and right displacements (23.10%) by laparoscopic exploration. Among them, 25 ectopic silver clips were removed simultaneously, and only one ectopic silver clip could not be removed because of difficulty in finding it. Unfortunately, this failed patient was unable to track and report the long-term outcomes. At the same time, it was found that many preoperative symptoms were not caused by sterilization of the silver clip but rather by the patient's underlying diseases, such as pelvic adhesion, pelvic venous congestion syndrome, hydrosalpinx, and ovarian endometriotic cysts. In addition, Chen *et al.* confirmed the same results^[17] that the detachment and displacement of the fallopian tube silver clip mainly occurred on the left side, with the greatest displacement occurring in the greater omentum, followed by the mesentery and peritoneum. During abdominal exploration surgery, it was confirmed that the preoperative clinical symptoms were all caused by related underlying diseases. This phenomenon of multiple occurrences on the left side may be related to anatomical factors, such as the possible influence of repeated peristalsis of the sigmoid colon, which

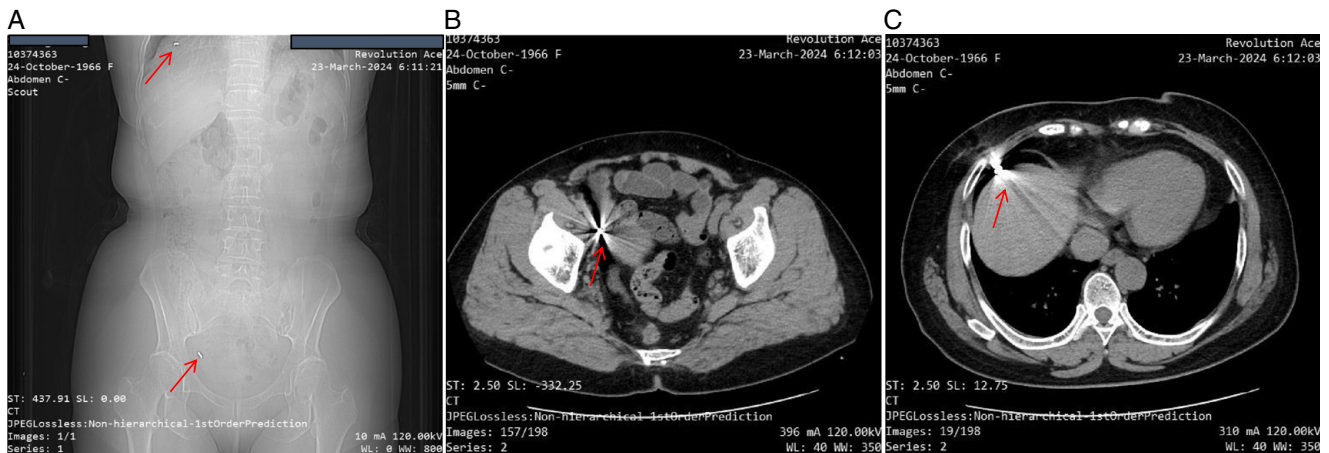


Figure 3. Computed tomography imaging of fallopian tube sterilization silver clip with detachment and displacement: Panel (A) shows that the position of the silver clip used for sterilization of the right fallopian tube is normal, while the left side has disappeared and moved to the upper right abdomen (red arrows). Panels (B) and (C) also clearly show a high-density metal shadow with strong metal artifacts at the right fallopian tube, while the left side has disappeared and is ectopic to the surface of the right liver and below its abdominal wall (red arrows).

requires further in-depth epidemiological research. In view of the above, although removal surgery was performed on the dislodged silver clip, it seemed that no definite and serious clinical complications caused by the dislodged silver clip were found during the operation. Based on currently limited clinical reports, many patients had unexpectedly discovered the detachment and displacement of the silver clip due to acute abdominal symptoms and routine imaging examination. The original cause was found during abdominal exploration surgery, and most of them were complicated by underlying diseases rather than ectopic silver clips^[18,19]. These pieces of evidence indirectly suggest that the surgical removal of detached contraceptive silver clips is a clinical issue that requires further confirmation.

Objectively speaking, whether it is necessary to completely remove the ectopic silver clip depends on whether the silver clip remaining in the body poses potential risks and hazards to the human body. Numerous basic studies have found that suitable trace amounts of silver have good tissue compatibility with human tissues, making it widely used in fields such as preventing infections^[18], promoting wound repair^[19,20], and as a plastic material in spinal surgery^[21]. This may be related to the reduction in foreign body reactions and venous intimal hyperplasia by inhibiting the expression of interleukin-33^[22], which is closely related to inflammatory responses^[23]. This indirectly indicates that silver has a good receptivity to human tissues. However, whether the silver content in human tissue caused by the corrosion of silver exceeds the body's tolerance depends on its concentration in the blood. Research has found that when silver clips are placed in the body for a long time, silver particles may settle in the local fallopian tube tissue, and there may also be silver particles settling on the walls of small blood vessels. The inner membrane of small blood vessels is stained with silver, and further research is needed to determine whether silver has entered the human blood circulation^[24]. However, a research initiated by Dr Dai confirmed this conclusion. This study found that women who underwent tubal silver clip sterilization had higher silver concentrations in their bloodstream, urine, and abdominal fluid than those who underwent other sterilization methods. One month after removal, there was no difference in silver concentration between the blood and urine, indicating that the silver in the fallopian tube silver clip was corroded in the body and entered the patient's bloodstream^[25]. This study directly confirmed that the long-term retention of silver clips in the body may lead to higher concentrations of silver in the blood than in the normal population. However, to date, there have been no reports or studies on the serious consequences of this high silver concentration in the bloodstream of human tissues. Finally, whether the detached and displaced silver clip must be removed may be often influenced more by the awareness of physicians and patients as well as the psychological factors of patients in clinical practice. This may be related to psychological factors, such as patient anxiety, tension, and inexplicable concerns, as well as the physician's targeted induction of conversation.

Conclusion

Although an ectopic silver clip is a type of MFB in the abdominal cavity, it belongs to the category of expected implantation of an MFB. At the same time, due to the good receptivity of silver to human tissue, it has been increasingly shown that removing the

silver clip is not necessary. However, the long-term effects of high concentrations of silver ions in the peripheral blood caused by long-term retention in the body of human tissues require further verification. Therefore, awareness of physicians and patients, as well as good communication between physicians and patients, may be more important in the management of the ectopic tubal sterilization silver clip.

Ethical approval

This is a case report; therefore, it did not require ethical approval from the ethics committee.

Consent

Written informed consent was obtained from the patient's parents for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Source of funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Author contribution

Z.L.: data interpretation and as a mentor and reviewer for this case report; C.Z.: performed an extensive literature review and writing of the paper; G.W.: a mentor and reviewer for this case report and provided analysis of imaging data; L.W.: undertook psychological communication and follow-up for the patient; Y.Z.: writing the paper.

Conflicts of interest disclosure

All of the authors declare that they have no conflicts of interest.

Research registration unique identifying number (UIN)

Not applicable.

Guarantor

Zijun Li, PhD, accepted full responsibility for the work and/or conduct of the study, had access to the data, and controlled the decision to publish.

Data availability statement

I confirm that any datasets generated during and/or analyzed during the current study are publicly available and also available upon reasonable request.

Provenance and peer review

Not commissioned, externally peer-reviewed.

References

- [1] Evans TN. Simplified method for sterilization of the female. *Am J Obstet Gynecol* 1953;66:393–5.
- [2] Hunan Province Salpingo Silver Clip Sterilization Research Collaboration Group Tubal, 1981. Sterilization with silver clips – clinical observation and follow-up of 1,182 cases (author’s transl). *Zhonghua Fu Chan Ke Za Zhi* 1981;16:52–4.
- [3] Qiu H, Li L, Wu S, *et al.* A comparative study of female sterilization via modified Uchida and silver clip techniques in rural China. *Int J Gynaecol Obstet* 2011;112:190–4.
- [4] Lawrie TA, Kulier R, Nardin JM. Techniques for the interruption of tubal patency for female sterilisation. *Cochrane Database Syst Rev* 2016;2016:CD003034.
- [5] Lin X, Wang J, Zhou B, *et al.* Laparoscopic surgery for the treatment of silver clip displacement after tubal sterilization: a case report. *J Wenzhou Med Coll* 2013;43:83–4.
- [6] Sohrabi C, Mathew G, Maria N, *et al.* Collaborators. The SCARE 2023 guideline: updating consensus Surgical CAse REport (SCARE) guidelines. *Int J Surg* 2023;109:1136–40.
- [7] Wang M, Liu GG, Zhao H, *et al.* The role of mediation in solving medical disputes in China. *BMC Health Serv Res* 2020;20:225.
- [8] Rodziewicz TL, Houseman B, Hipskind JE. Medical Error Reduction and Prevention. StatPearls. StatPearls Publishing; 2024. PMID: 29763131.
- [9] Signorelli F, Montano N. Use and efficacy of hemostats in neurosurgery. *Surg Technol Int* 2020;37:414–9.
- [10] Zhu WH, Jiang HG, Liu J. Application of metal clip with endoscopic treatment for difficult cases of immediate hemostasis of esophago-gastric variceal bleeding. *Zhonghua Gan Zang Bing Za Zhi* 2020;28:266–8.
- [11] Wu J, Su T, Zhang J, *et al.* Angle of titanium clip next turbinate resection without filling in the clinical observation. *Lin Chuang Er Bi Yan Hou Tou Jing Wai Ke Za Zhi* 2014;28:1347–9.
- [12] Verma P, Saxena S, Gunjan, *et al.* Comparative study on menstrual disorders in post-tubal ligated and non-ligated women. *J Family Med Prim Care* 2023;12:2482–7.
- [13] Takahashi H, Puttler KM, Hong C, *et al.* Sigmoid colon penetration by an intrauterine device: a case report and literature review. *Mil Med* 2014; 179:e127–9.
- [14] Makni C, Souissi S, Saidani A, *et al.* Retrait endoscopique d’un dispositif intra-utérin perforant le côlon sigmoïde: à propos d’un cas [Endoscopic removal of intrauterine device perforating the sigmoid colon: case report]. *Pan Afr Med J* 2022;42:175.
- [15] Wahba AH, Auer-Schmidt MM, Schmidt T. Endoscopic removal of intrauterine contraceptive device perforating into the bladder: a case report and review of literature. *Cureus* 2023;15:e35839.
- [16] Wei C, Zhu G, He X, *et al.* Video laparoscopic operational treatment of silver clips displacement after tubal sterilization by silver clips. *Matern Child Health Care China* 2007;25:3559–61.
- [17] Chen J, He X, Han L, *et al.* Clinical application of laparoscopic technique in the treatment of 29 patients with ectopic silver clips in the fallopian tubal sterilization. *Jiang Xi Yi Yao* 2014;8:725–7.
- [18] Liao C, Li Y, Tjong SC. Bactericidal and cytotoxic properties of silver nanoparticles. *Int J Mol Sci* 2019;20:449.
- [19] Mehwish HM, Liu G, Rajoka MSR, *et al.* Therapeutic potential of *Moringa oleifera* seed polysaccharide embedded silver nanoparticles in wound healing. *Int J Biol Macromol* 2021;184:144–58.
- [20] Grizzo A, Dos Santos DM, da Costa VPV, *et al.* Multifunctional bilayer membranes composed of poly(lactic acid), beta-chitin whiskers and silver nanoparticles for wound dressing applications. *Int J Biol Macromol* 2023;251:126314.
- [21] Morimoto T, Hirata H, Eto S, *et al.* Development of silver-containing hydroxyapatite-coated antimicrobial implants for orthopaedic and spinal surgery. *Medicina (Kaunas)* 2022;58:519.
- [22] Zhang C, Wei S, Zhang L, *et al.* [Silver ion decreases foreign body reaction and venous neointimal hyperplasia through the inhibition of interleukin-33 expression]. *J Vasc Res* 2024;61:89–98.
- [23] Cayrol C, Girard JP. Interleukin-33 (IL-33): a critical review of its biology and the mechanisms involved in its release as a potent extracellular cytokine. *Cytokine* 2022;156:155891.
- [24] Xiao Y, Li Y. Histological changes of the fallopia tubes and test with electronic probe after tubal sterilization with silver clips. *J Reprod Med* 1993;2:107–10.
- [25] Dai L. Determination of silver concentration in body fluids of women sterilized with silver clips [Collection of Doctoral dissertations], Hebei Medical University, 2022. <https://cdmd.cnki.com.cn/Article/CDMD-10089-1022719901.htm>