TRAINING MANUAL

NO SCALPEL VASECTOMY (NSV)

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TRAINING MANUAL

I. NO SCALPEL VASECTOMY - NSV (Technique)

Compiled and modified by: World Vasectomy Day 2024

1. VASECTOMY

Vasectomy is a surgical procedure that divides and occludes the vas deferens to prevent the passage of sperm and their mixing with seminal fluids, thus permanently preventing pregnancy. The procedure takes approximately 15 minutes and can be performed in a properly equipped office or an outpatient surgery center.

Compared to tubal ligation, which is also a permanent method of contraception, a vasectomy is equally effective in preventing pregnancy. However, vasectomy is simpler, faster, safer and less expensive. Vasectomy is one of the most cost-effective contraceptive methods, its cost is about a quarter of the cost of tubal ligation. Vasectomy requires less time away from work, requires only local anesthesia rather than general anesthesia, and is usually performed in a doctor's office or clinic. The possible complications of vasectomy are less serious than those of tubal ligation.

Throughout the world, the discrepancy between vasectomy and tubal ligation is very marked. Data compiled in 2019 by the Population Division of the United Nations Department of Economic and Social Affairs shows that 16 million women of reproductive age, between 15 and 49 years old, used vasectomies as a contraceptive method, compared to 219 million who resorted to the tubal ligation. There are only eight countries in which the use of vasectomy is equally or more common than tubal ligation as a contraceptive method: Korea, Canada, the United Kingdom, New Zealand, Bhutan, the Netherlands, Denmarkbrand and Austria.

Since vasectomy and tubal ligation have equivalent contraceptive efficacy and vasectomy has advantages compared to tubal sterilization (lower cost, less pain, greater safety, and faster recovery), vasectomy should be considered more frequently for permanent contraception than in current practice.

1.1 History of no-scalpel vasectomy

No-scalpel vasectomy was developed and first performed in China in 1974 by Dr. Li Shunqiang of the Chongqing Scientific Research Institute of Family Planning, located in Sichuan province. At the time, vasectomies were unpopular among Chinese men and tubal occlusion was the predominant method of voluntary sterilization.

Under the sponsorship of EngenderHealth, an international team of experts visited Dr. Li Shunqiang in 1985 and observed his refined vasectomy technique. They were convinced that the technique should become the standard method for vasectomy. One of the team members, Dr. Phaitun Gojaseni, introduced the no-scalpel technique to Thailand upon his return, while another member of the team, Dr. Marc Goldstein, performed the first no-scalpel vasectomy in the United States.

Based on the international team's findings, EngenderHealth recommended that training in the no-scalpel approach to the vas deferens should be provided to physicians in other countries and that this be would facilitate if the instruction could be carried out outside of China. EngenderHealth's initial work on no-scalpel vasectomy focused on vasectomists experienced in large ongoing vasectomy services (Huber, 1989). However, with the expansion of clinical training to other countries, it has become clear that new doctors receiving training for the first time should be trained only in the no-scalpel technique.

World Vasectomy Day, as an organization that promotes male participation in contraception through vasectomy, has an established commitment not only to the popularization of the procedure but also to the training of the human resource necessary for the proliferation of vasectomy.

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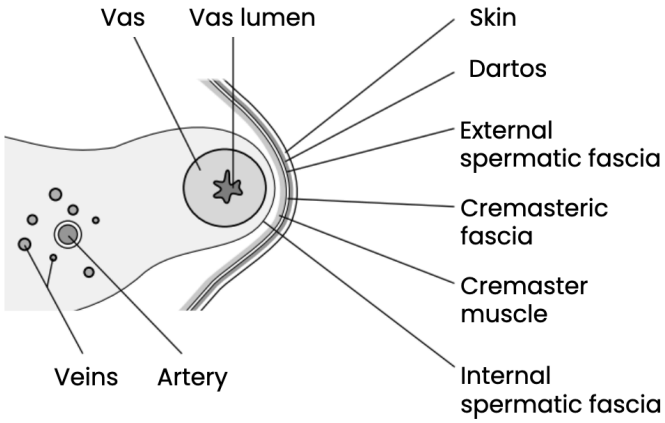
2. ANATOMICAL REVIEW

The scrotum houses and protects the testicles. It has a unique anatomy, and its structure can be described in layers from the outermost to the innermost, and also includes the vasculature of the testicles and the vas deferens.

2.1 layers of the scrotum



Layers of the scrotum (Engender Health, 2007)

Skin: The scrotum is covered by a layer of skin, which is thinner and often darker than the skin on the rest of the body. The main function of the skin is to protect the underlying structures and help regulate the temperature of the testicles by expanding and contracting.

Dartos muscle layer: Under the skin, there is a layer of smooth muscle called the dartos muscle. The dartos muscle is responsible for the wrinkled appearance of the skin of the scrotum and plays a role in regulating the temperature of the testicles by contracting or relaxing to adjust the distance between the testicles and the body.

External spermatic fascia: Beneath the dartos muscle, there is a layer of connective tissue known as the external spermatic fascia. This fascia surrounds the testicles and helps protect and support them within the scrotum.

Cremaster muscle layer: Deeper still is the cremaster muscle, a layer of skeletal muscle. This muscle is connected to the internal oblique muscle of the abdominal wall and helps regulate testicular temperature by moving the testicles closer or further away from the body.

Internal spermatic fascia: The internal spermatic fascia is the next layer and is another sheath of connective tissue that helps contain the structures within the scrotum.

Tunica vaginalis: The testicles are covered by a double-layered membrane called the tunica vaginalis. This membrane surrounds and protects the testicles while allowing them some mobility.

Tunica Albuginea: Beneath the tunica vaginalis, the testicles are surrounded by the tunica albuginea, a dense white fibrous tissue. Within the testicles there are numerous seminiferous tubules where sperm production occurs.

Spermatic cord: serves as a suspensory structure for the testicles and facilitates the passage of crucial components. It includes:
- Arteries (testicular arteries that branch from the aorta)
- Veins
- Nerves
- Vas deferens

Vas deferens: These are muscular tubes that transport sperm from the epididymis (where sperm mature and are stored) to the urethra. They are located within the spermatic cord and are surrounded by several layers, including connective tissue and smooth muscle, which help propel sperm during ejaculation.

Vasculature: The spermatic cord also contains the deferential artery (artery of the vas deferens) and the pampiniform plexus. The pampiniform plexus consists of 8 or 10 veins that lie adjacent to the vas deferens and finally drain into the testicular vein. These veins are easily injured during aggressive dissection of the spermatic cord. Dilation of the pampiniform plexus (called a varicocele) is a common abnormality and usually occurs on the left side.

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3. VASECTOMY TECHNIQUES

There are two key surgical steps when performing a vasectomy:

1. Vas isolation
2. Vas occlusion

The risks of intraoperative and early postoperative pain, bleeding, and infection are primarily related to the method of vas isolation. Vasectomy success and failure rates are related to the method of vas occlusion.

3.1 Vas isolation

The methods of vas isolation include the conventional (CV) technique and the minimally invasive (MIV) technique, which includes the no-scalpel technique known as no-scalpel vasectomy (NSV).

3.1.1 Conventional Vasectomy (CV)

The CV technique was the most common technique before the introduction of minimally invasive techniques (MIV). CV is performed through a midline incision or bilateral scrotal incisions with a scalpel. The incisions are usually 1.5 to 3 cm. No special instruments are used during CV and the vas deferens is usually grasped with a towel clamp or Allis clamp. During CV, the area of scrotal dissection is usually much larger than that which occurs with MVI techniques (see below).

3.1.2 No-scalpel Vasectomy (NSV)

The no-scalpel vasectomy technique was developed in 1974 in China by Dr. Li Shunqiang to make vasectomy a more acceptable method of contraception. The NSV isolation technique was the first minimally invasive technique for vasectomy. In this technique, specially designed instruments are used to facilitate the procedure in a minimally invasive way.

3.1.3 Minimally Invasive Vasectomy (MIV)

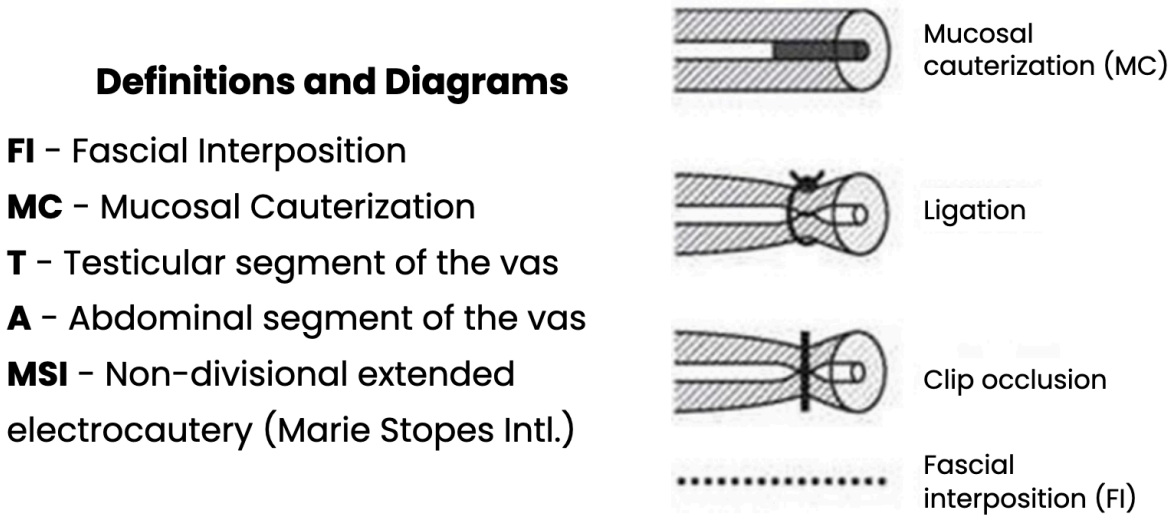
The term “minimally invasive vasectomy” includes any vas isolation procedure, including the NSV technique, which incorporates two key surgical principles:

- Small openings (≤10 mm) in the skin of the scrotum, either as a single opening in the midline or as abilateral openings
- Minimal dissection of the vas deferens and perivasal tissues, which is facilitated by the use of a vas ring clamp and a vas dissector, or similar special instruments.

Recent advances in vasectomy have shown that the no-scalpel approach for exposing the vas deferens (known as no-scalpel vasectomy or NSV) reduces the risk of surgical complications compared to incisional techniques.

3.2 Vas occlusion

The occlusion of the vas deferens is the determining step that establishes the effectiveness of the vasectomy. Depending on the way the vas deferens occlusion is performed, there will be greater certainty in obtaining low failure rates that present satisfactory results for the patient.



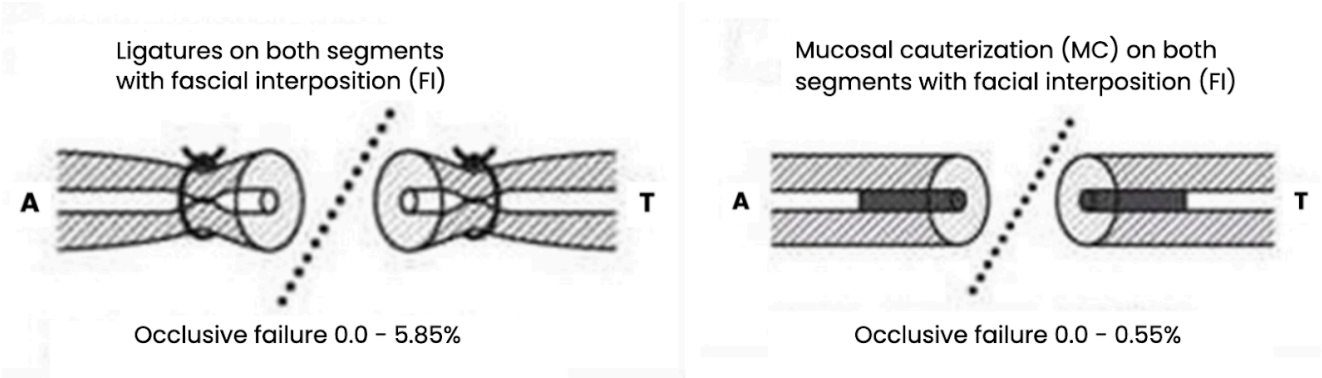
Definitions and diagrams of occlusion (AUA, Vasectomy Guidelines 2012)

According to the *American Urological Association* (AUA, 2012), the most used vasectomy occlusion techniques are the following:

3.2.1 Fascial Interposition (FI)

Fascial interposition (FI) is the technique of placing a layer of internal spermatic fascia between the two divided ends of the vas deferens..

The fascial layer can be placed over the testicular or abdominal end. It is usually combined with other techniques such as ligation and excision or mucosal cautery.

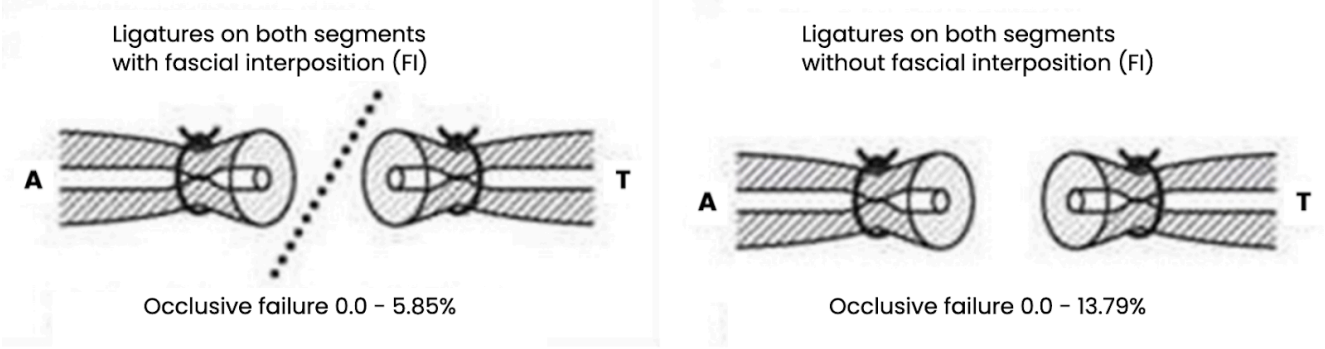


Occlusion techniques including FI (dotted line) (AUA, Vasectomy Guidelines 2012)

3.2.2 Ligation

Ligation means occlusion of the vas deferens with ligations, with division/excision of the vas deferens between the occluded points, and with or without FI.

The number of ligatures at each end of the divided duct varies between one (the most common) and three. The length of the removed vas deferens segment is usually approximately 1 cm, but varies between 0 and 5 cm.

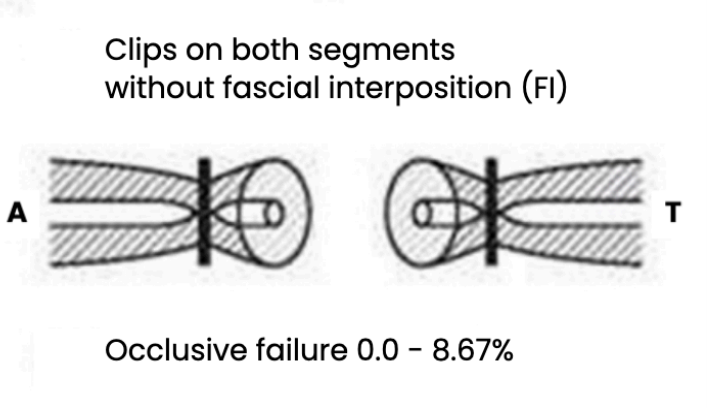


Occlusion techniques including ligatures (AUA, Vasectomy Guidelines 2012)

3.2.3 Clips

Clips means occlusion of the vas with surgical/hemostatic clips, with division/excision of the duct between the occluded points, and with or without IF.

The number of clips placed at each end of the split duct is usually one or two, but can be more.



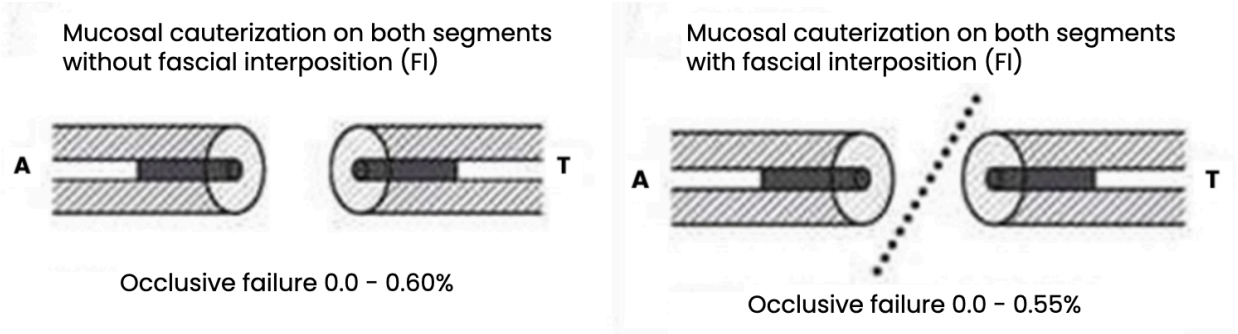
Occlusion technique that includes the use of clips (AUA, Vasectomy Guidelines 2012)

3.2.4 Mucosal Cauterization (MC)

Mucosal cautery (MC) is the technique of applying thermal or electrical cautery to the mucosa of the cut ends of the vas deferens to destroy the mucosa, while avoiding or minimizing any damage to the muscle layers. The goal of MC is to create a plug of scar tissue that occludes the lumen of the vas deferens.

The length of the cauterized segment varies from a few mm to 1.5 cm. MC can be combined with excision of a segment of the vas deferens or FI.

Cauterizing the mucosa while limiting cautery damage to the muscular layer of the duct prevents detachment of the cauterized portion of the vas, which could occur if the cautery destroys its entire thickness.



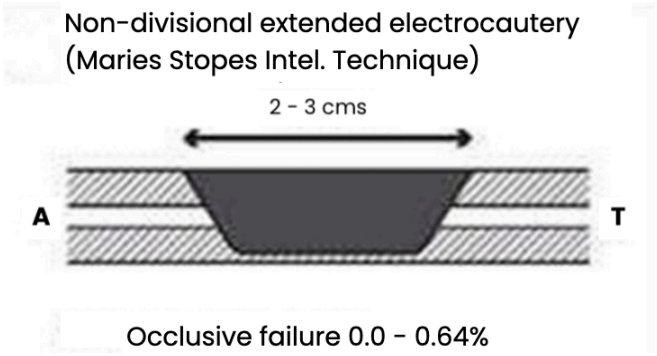
Occlusion techniques including mucosal cautery (AUA, Vasectomy Guidelines 2012)

3.2.5 Extended Electrocautery

The non-divisional extended electrocautery technique of vas deferens occlusion (Marie Stopes International technique) consists of electrocoagulation of the full thickness of the anterior wall and a partial thickness of the posterior wall of the vas deferens over a length of approximately 2.5 to 3 cm without dividing the vas deferens.

It is the only technique that does not completely divide the canal. It uses a monopolar electrocautery administered by a Hyfrecator through a reusable needle.

The technique was developed by Marie Stopes International in London (UK) as a vasectomy technique that could be easily disseminated.



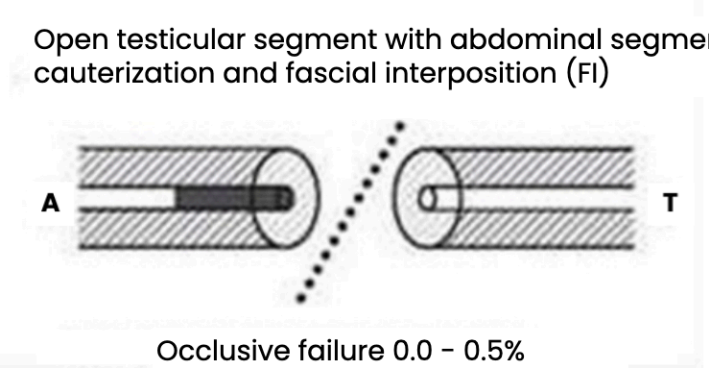
Extended electrocautery technique (Marie Stopes Intl.) (AUA, Vasectomy Guidelines 2012)

3.2.6 Open testicular segment

Open vasectomy is the technique of leaving the testicular end of the divided vas unoccluded, while the abdominal end is occluded.

The hypothetical goals of this technique are 1) to prevent or reduce post-vasectomy pain by decreasing back pressure on the epididymis and 2) to allow the formation of a sperm granuloma at the severed testicular end of the vas deferens, which some experts consider could increase the probability of success of a potential vasectomy reversal.

When an open vasectomy is performed, FI is used to prevent recanalization.



Occlusion technique with open testicular segment (AUA, Vasectomy Guidelines 2012)

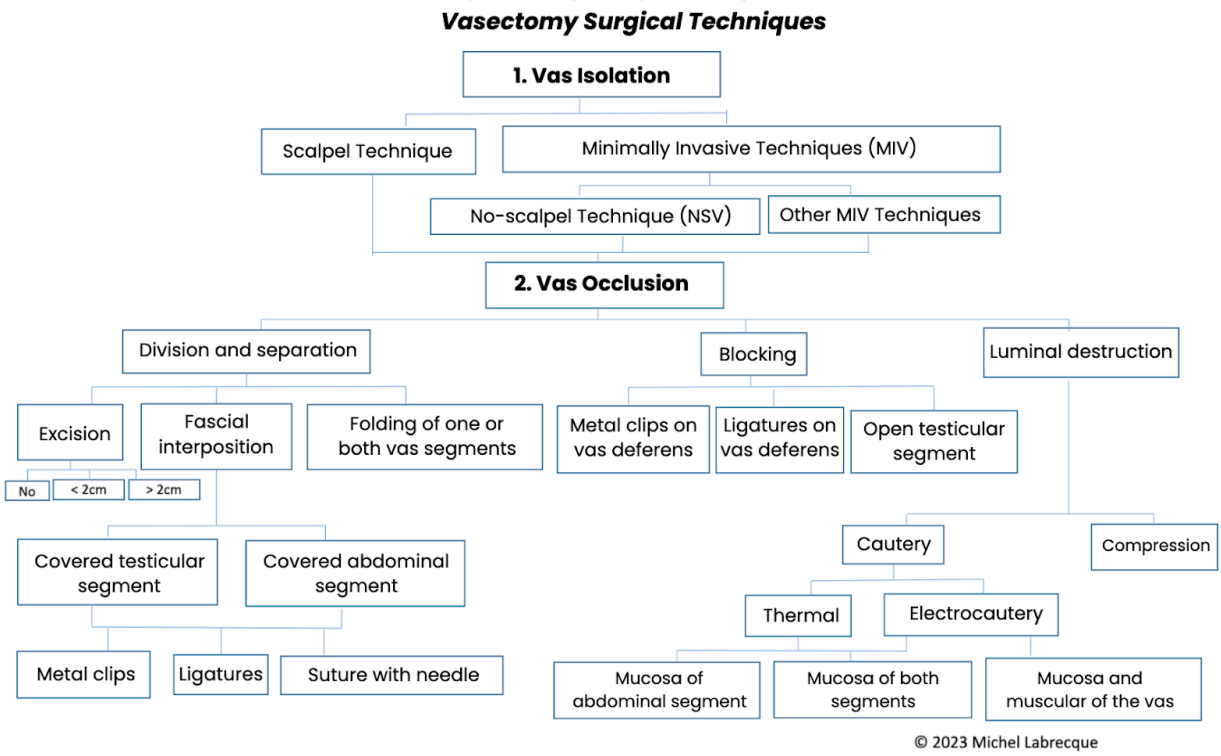


Diagram of vasectomy surgical techniques (Michel Labrecque, 2023)

Cauterization of the mucosa of the lumen of the vas deferens (MC), combined with fascial interposition (FI), appears to achieve the most effective occlusion of the vas deferens.

The occlusion technique presented in this manual is that with cauterization of the abdominal segment (MC) with interposition of the fascia (FI) and the open testicular segment.

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4. INSTRUMENTS

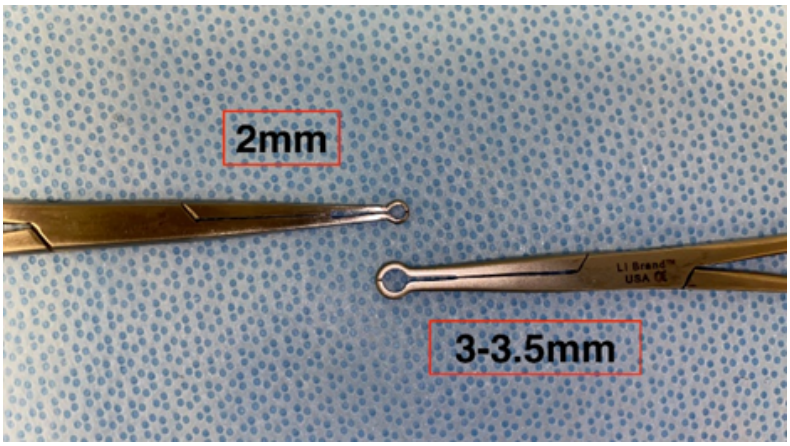
The no-scalpel technique described in this document requires four instruments, two of which were specially designed by Dr. Li Shunqiang.

4.1 Extra cutaneous ringed forceps

This is a type of surgical clamp used to secure the vas deferens. For clarity, the term ring froceps will be used in this document. Throughout the procedure, the surgeon uses the ringed tip of this instrument to surround and grasp the vas deferens, without damaging the skin.

The forceps grasps the vas deferens both extracutaneously and directly. This instrument comes in different ring sizes: 2.0 mm, 3.0 mm, 3.5 mm and 4.0 mm. These different diameters adapt to different thicknesses of vasa and scrotal skin. Routinely a 3.0 to 3.5 mm ring forceps is sufficient to perform most procedures.

Ringed Forceps (designed by Dr. Li)



Ring Forceps Sizes

4.2 Li Dissecting Forceps

They are similar to a curved mosquito hemostat, except that the tips are pointed. They are used to pierce the skin of the scrotum, extend the tissues, dissect the sheath, and expel the vas deferens.

The dissecting forceps can also be used to hold the vas while a ligature or cautery is applied for occlusion. Because the instrument is a modified hemostat, it can be used to control bleeding. Throughout this document, the term Li forceps will be used to refer to this instrument.

Li Forceps (designed by Dr. Li)

4.3 Straight hemostatic forceps without teeth

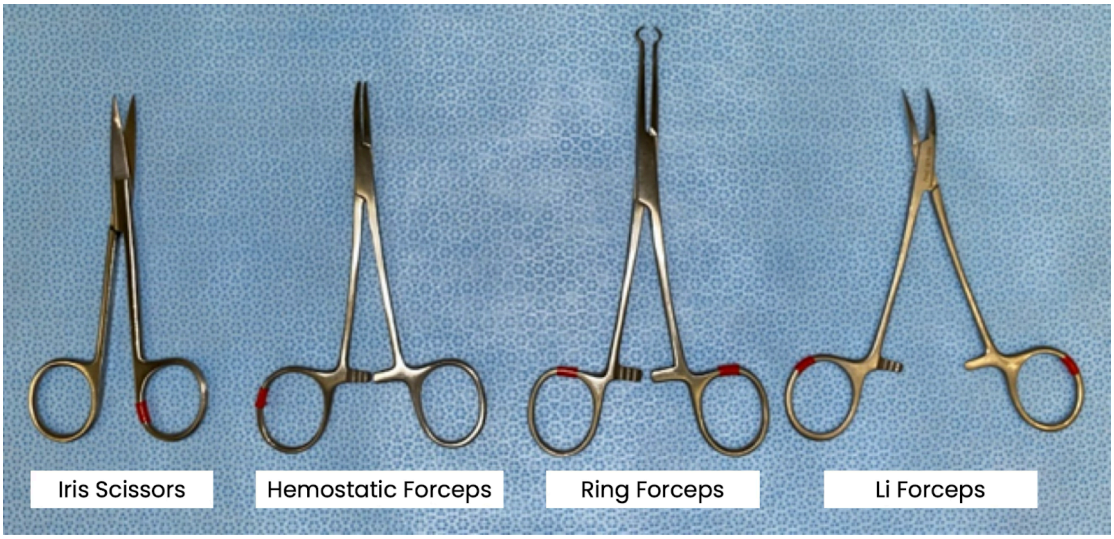
Also described as mosquito hemostatic forceps, these forceps are necessary for fascial interposition and as a tool for hemostasis.

Mosquito forceps

4.4 Iris scissors

They are used for hemisection of the vas deferens and cutting of sutures.

Iris Scissors

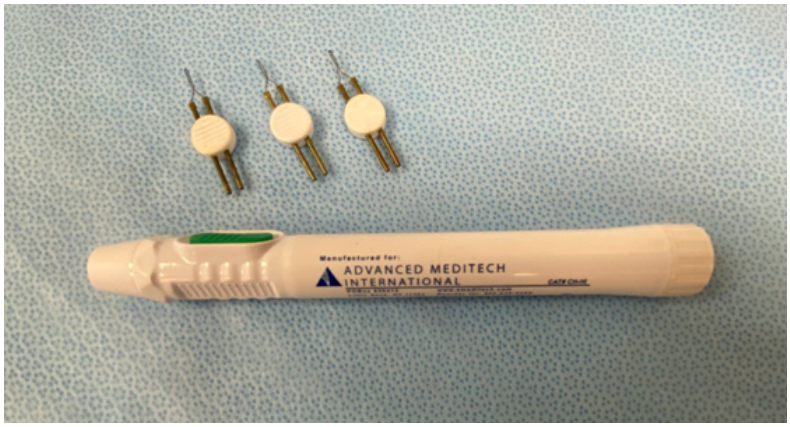


Instrumentation required for vasectomy

4.5 Battery-powered thermal cautery

It is a device for thermal cautery that works with regular AA type batteries, whose main function during the procedure is to seal, or occlude, the vas deferens; thus preventing the release of sperm during ejaculation.

The tip of the device, in the lumen of the vas deferens, dries the luminal mucosa of the vas to create a firm scar that occludes the vas.



Thermal cautery

5. PREOPERATIVE COUNSELING

There should be a discussion with the patient before the vasectomy. Like any surgical procedure, a vasectomy requires an interactive discussion about risks, benefits, and alternatives.

Patients who choose a vasectomy are choosing to make a permanent change in their fertility status. Some patients may later regret this decision. Therefore, a thoughtful preoperative discussion is important. The goal of this discussion is to ensure that the patient has appropriate expectations regarding the preoperative, operative and postoperative consequences choosing a vasectomy.

The surgeon performing the vasectomy should obtain a general medical history, with special emphasis on any bleeding diathesis and other possible contraindications to the procedure. For example, if a patient requires chronic anticoagulation and the risks of discontinuing anticoagulation are significant, then the surgeon and patient should consider alternative methods of family planning.

A physical examination of the genitals should be performed before vasectomy. This examination may be performed immediately before the surgical procedure, if the preoperative consultation was not performed in person. Physical examination at the time of the in-person preoperative consultation is useful because it may help identify genital pathology, such as a testicular tumor or an undescended testicle, which contraindicates routine bilateral vasectomy. Additionally, the physical examination may identify patients who are not good candidates for local anesthesia due to unusual scrotal tenderness, patients who are too uncomfortable or too anxious to tolerate vasectomy under local anesthesia, or patients whose vasa are especially difficult to palpate.

According to *American Urological Association* (AUA, 2012), the minimum necessary concepts that should be discussed in a preoperative vasectomy consultation include the following:

- Vasectomy is considered a permanent form of contraception.
- Vasectomy does not produce immediate sterility.
- After vasectomy, another form of contraception is required until duct occlusion is confirmed by post-vasectomy semen analysis (PVSA).
- Even after confirming vas deferens occlusion, vasectomy is not 100% reliable in preventing pregnancy.

- The risk of pregnancy after vasectomy is approximately 1 in 2000 for men who have post-vasectomy azoospermia or PVSA showing rare non-motile sperm (RNMS) (defined as ≤100,000 sperm/ml).
- Repeat vasectomy is necessary in ≤1% of vasectomies, provided that a technique for vas occlusion known to have a low occlusive failure rate was used (defined as a technique with less than 1% failure)
- Patients should refrain from ejaculating for about a week after vasectomy.
- Options for fertility after vasectomy include vasectomy reversal and sperm retrieval from the testicle, with in vitro fertilization. These options are not always successful, can be very expensive, and not always locally available.
- Rates of surgical complications such as symptomatic hematoma and infection are 1 to 2%. These rates vary depending on the experience of the surgeon and the criteria used to diagnose these conditions.
- Chronic scrotal pain associated with a negative impact on quality of life occurs after vasectomy in approximately 1-2% of men. Few of these men require additional surgery to improve their symptoms.
- The benefits and risks of other permanent contraceptive methods (e.g. tubal sterilization) and/or non-permanent options should be reviewed for the patient (e.g. barrier methods) and the partner (e.g. oral or injectable contraceptives, and barrier methods).
- If the female partner is pregnant at the time of the preoperative consultation, the couple may be advised to consider delaying vasectomy until after delivery to avoid vasectomy regret, which could occur if the pregnancy is lost unexpectedly.

5.1 Precautions and contraindications

The following are conditions that require a delay of the procedure or special precautions:

- Local infection: including scrotal skin infection, active sexually transmitted infection (STI), balanitis, epididymitis or orchitis.
- Previous scrotal injury
- Systemic infection or gastroenteritis.
- Large hydrocele
- Filariasis, scrotal elephantiasis
- Local pathological condition (eg. intraescrotal mass, cryptorchidism or inguinal hernia)
- Bleeding disorders

- Diabetes
- AIDS (HIV positive status without AIDS is not a concern).

Many of these conditions can be treated, after which vasectomy can be performed. In cases where there is a higher risk, the surgeon and patient must weigh the risks of the procedure against its benefits.

5.2 Minimum age

The minimum age requirement for vasectomy should be that of legal consent in the jurisdiction in which the procedure is performed. The prospective vasectomy patient must, at a minimum, be of the legal age of consent under applicable legal statutes. Access to a vasectomy procedure should not be restricted on the basis of the patient's age or number of children he's fathered.

5.3 Consult with your partner

Any adult male of legal age to consent to the procedure can proceed with a vasectomy without consulting his partner. However, because a potential vasectomy patient's decision affects the fertility options for both, him and his partner or spouse, it is suggested to include the partner in the preoperative consultation and decision-making process. However, the couple's permission is not necessary or required to perform the procedure.

5.4 Dissatisfaction and regret

Rates of dissatisfaction with vasectomy and/or regret for having undergone the procedure are in the range of 1-2%. It is estimated that 80 to 100% of vasectomized men recommend the procedure to others.

In the few studies that have assessed reasons for dissatisfaction or regret, the most commonly reported reason is the desire to have more children.

5.5 Laboratory tests

Preoperative laboratory testing is not required for vasectomy patients, unless the patient's medical history suggests they may be necessary to evaluate the patient's suitability for the vasectomy procedure.

In particular, preoperative coagulation testing should be considered only if the patient has a history of liver disease, bleeding diatheses, or is taking anticoagulants.

5.6 Preoperative antibiotics

Prophylactic antimicrobials are not indicated for routine vasectomy unless the patient is at high risk of infection.

When operating on certain patients who have comorbidities associated with a particularly high risk of infection, the surgeon should consider the use of prophylactic antimicrobials.

5.7 Use of anti-inflammatories

Patients should avoid taking aspirin and nonsteroidal anti-inflammatory drugs for seven days before the procedure, as they may increase the risk of postoperative bleeding.

5.8 Management of operative anxiety

The administration of an anxiolytic (e.g., diazepam 10mg orally or alprazolam 0.5-1mg orally) can be considered approximatelyate one to two hours before the procedure to help relax the patient.

The use of anxiolytics can help with surgical isolation of the vas deferens by relaxing the scrotal and cremasteric muscles. Although the use of anxiolytics is exceptional, it could be a good alternative to the administration of general anesthesia in certain cases.

When using anxiolytics, informed consent should be obtained before administration of the medication.

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6. PROCEDURE SEQUENCE

6.1 Preparation

The patient is asked to lie supine on the procedure table. It is helpful to place and secure the penis in the lower abdomen (e.g., with a surgical drape, tape, or elastic band).

Hair is cut from the anterior scrotum, which is then prepared with an antiseptic solution. Gently wash the scrotum. Be sure to clean the area under the scrotum where the fingers will be placed. Also rub the lower abdomen, the lower part of the penis and the upper part of the thighs.

6.2 Washing solution

Preferred agents are Betadine (povidone iodine) or chlorhexidine. A useful, and quite effective, mixture for preparing the scrotum is a solution of 4% chlorhexidine, 70% alcohol and drinking water (sterile is not required) in a proportion of 25%, 25% and 50% respectively.

After scrotal lavage, sterile surgical drapes are used to cover the area surrounding the scrotum, using sterile technique for the remainder of the procedure.

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7. ADMINISTRATION OF ANESTHESIA

Vasectomy can be performed safely in almost all patients using only local anesthesia.

Occasionally, supplemental oral or intravenous sedation may be optimal or necessary for the few patients who cannot tolerate vasectomy with local anesthesia alone. For the rare patients in whom preoperative examination suggests that isolation of the vas

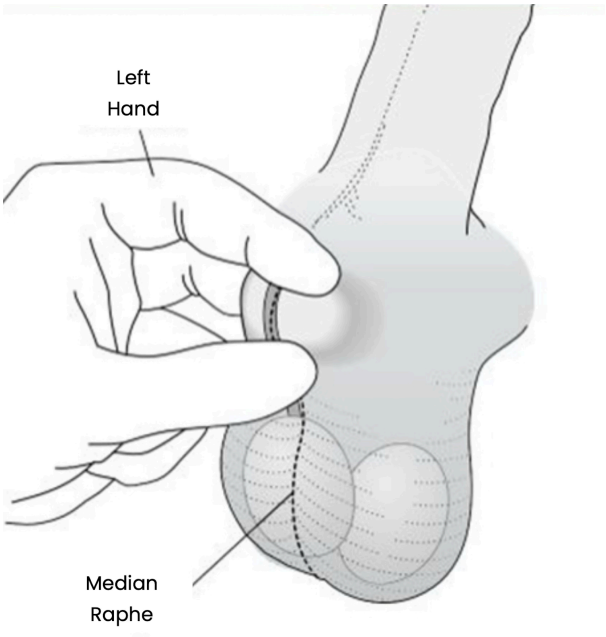
deferens will be particularly difficult and in whom oral or intravenous sedation is unlikely to be sufficient for patient comfort, general anesthesia may be necessary.

In cases where intravenous sedation or general anesthesia is considered, the patient must be referred to the corresponding service that can perform the procedure under these conditions.

7.1 Vas isolation (no-scalpel technique)

7.1.1 The three-finger technique to isolate the vas deferens

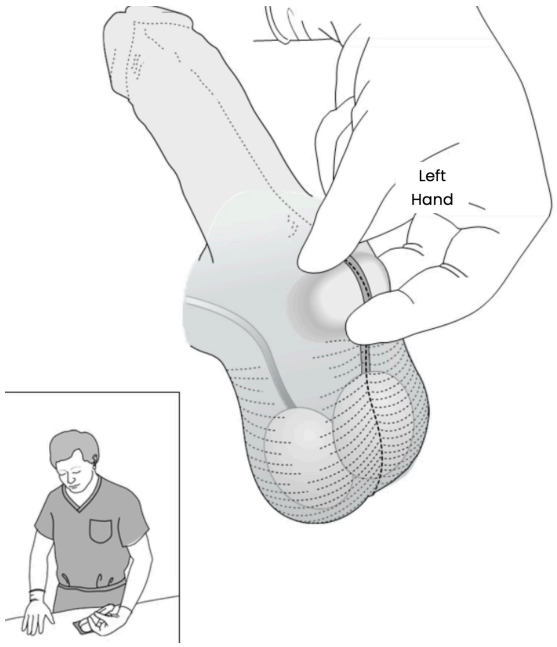
1. Stand on the right side of the patient (if the operator is right-handed)
2. For the **right vas deferens**:
    a. Place your left thumb approximately halfway between the top of the testicles and the base of the penis at the median raphe. With the middle finger of the left hand under the scrotum, palpate the duct slide it towards the median raphe under the thumb.
    b. Hold the vas deferens in position between your thumb and middle finger while placing your left index finger on top of the scrotum, slightly above your thumb.



"Three Fingers Technique" for the Right Vas (Engender Health, 2007)

c. Note that your fingers should be perpendicular to the vas deferens. The upward pressure from the middle finger, combined with the downward pressure exerted by the index finger, creates a curve in the vas to facilitate entry for its exposure. Maintain a three-finger grip when administering anesthesia to the right side.

3. For the isolation of **left vas**, the position of the hands will be reversed.
    a. To hold the patient's left vas with the three-finger technique while standing on their right side, you will feel more comfortable if you step toward the patient's head and turn slightly to face their feet. To approach the vas deferens from this lateral position, pass your left hand over the patient's abdomen.
    b. For a right-handed operator, isolating the left duct may be more difficult and uncomfortable than isolating the right vas. It may take time and practice to master. A left-handed operator will need to reverse these positions and therefore may find it more difficult to isolate the right vas.



"Three Fingers Technique" for the Left Vas (Engender Health, 2007)

7.2 Anesthetic Administration with the Mini-needle Technique

7.2.1 Selection of anesthetic and supplies

Prepare a 3cc syringe to administer 2cc of lidocaine 2% ine without epinephrine. This amount should be sufficient for anesthesia with a vasal block and skin anesthesia in most clients. Attach a small gauge 0.5 or 1 inch (the metric equivalent) to the syringe. A 30 gauge needle is recommended for minimal patient discomfort.

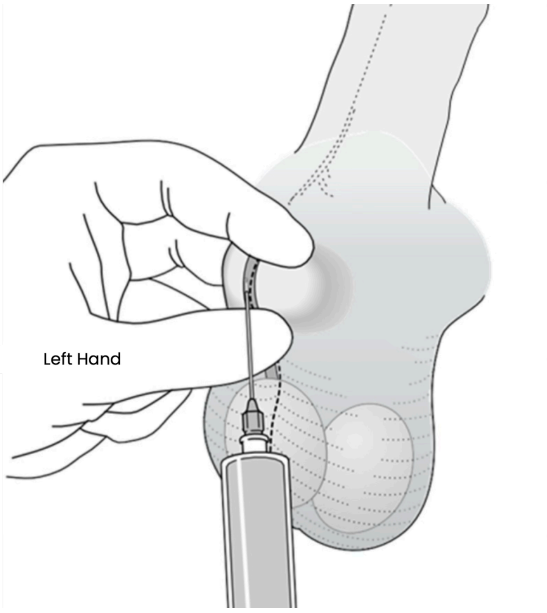
Epinephrine is not recommended because it constricts blood vessels and causes less apparent bleeding at the time of surgery. It is best to be able to detect and control all bleeding during the procedure to prevent bruising after the patient leaves the medical facility. If lidocaine does not contain epinephrine, it is more likely to be able to detect and control small bleeding sites during the procedure.

The maximum individual dose of lidocaine without epinephrine should not exceed 4.5 mg/kg (2 mg/lb) of body weight. In general, it is recommended that the maximum total dose not exceed 300 mg. This is equivalent to 30 cc of 1% lidocaine or 15 cc of 2% lidocaine without epinephrine.

7.2.2 Administration procedure

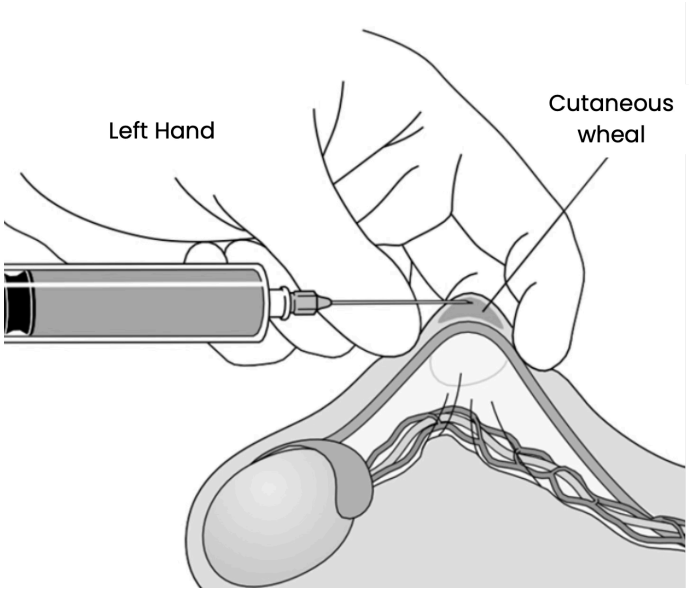
Administration of the local anesthetic is crucial for a good patient experience during the procedure. It is imperative that the anesthetic be applied appropriately and sufficiently for a painless vasectomy.

1. The vas deferens is isolated and positioned so that it lies as superficially as possible under the median raphe of the skin of the scrotum, anteriorly, and halfway between the top of the testicles and the base of the penis. This is usually accomplished using the non-dominant hand and the "three-finger technique", already described, to manipulate the vas within the scrotum.
2. Local anesthetic without epinephrine (0.5 ml) is injected into the skin to create a wheal on the skin over the vas deferens. A large wheal should be avoided because it will interfere with the isolation of the vas deferens.
    a. The needle entry site should be in the midline, over the vas deferens, and halfway between the thumb and index finger. Use only the tip of the needle to lift a superficial skin wheal, 1 to 1.5 cm in diameter.



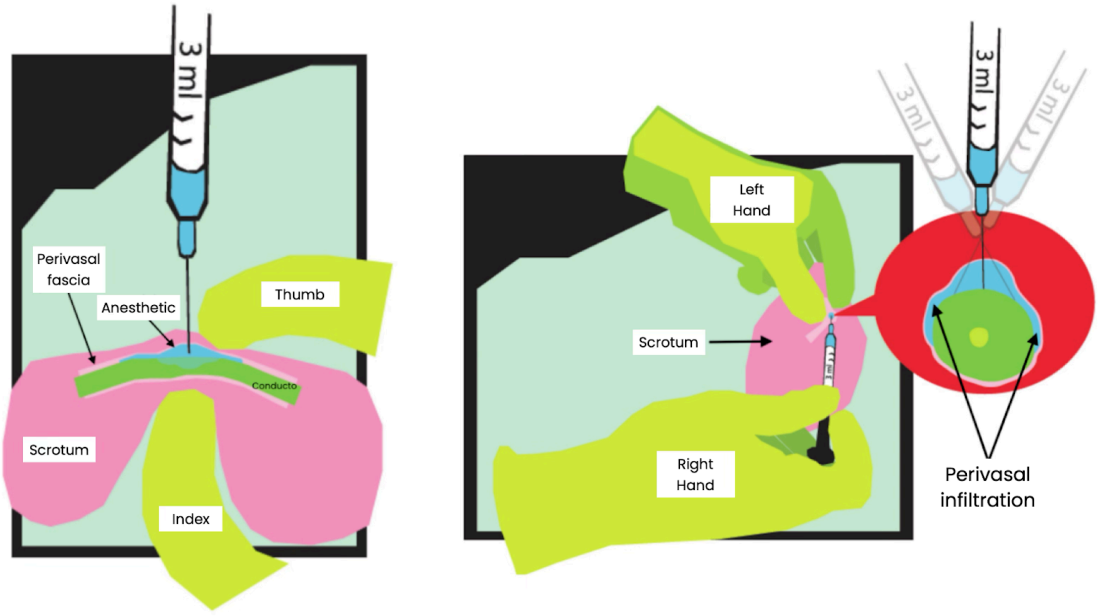
"Three Fingers Technique" for Right Vas and Wheal Creation (Engender Health, 2007)

b. To create the skin wheal, hold the syringe at an angle of about 5 to 15 degrees, with the bevel of the needle facing up. Inject lidocaine into the dermis and subcutaneous tissues. Generally 0.5 cc would be sufficient.
    - *Avoid two potential mistakes when lifting the skin wheal:*
        1. First, do not inject the lidocaine too deeply. At this point in the procedure, you are anesthetizing only the skin of the scrotum. In the next step, you will create a vasal block that will anesthetize the deeper tissues.
        2. Secondly, to avoid swelling around the vas deferens at the puncture site, do not inject more than 1 cc of lidocaine. A persistent wheal will prevent the ring clamp from closing properly around the vas deferens.



Creation of the "skin wheal" (Engender Health, 2007)

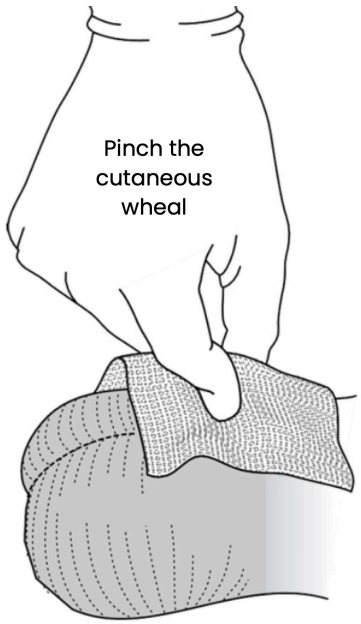
3. **Right vas anesthesia**: Using the small numb spot you created, advance the needle directly into the vas deferens. Once you feel the vas deferens with the tip of the needle, inject approximately 0.5-1 ml of lidocaine.
    a. The goal is to inject lidocaine into the space just between the vas deferens and the fascia surrounding it.
    b. Be sure to anesthetize both sides, using the same technique, before entering the scrotum and occluding the right vas.



Perivasal anesthetic infiltration scheme (Michel Labrecque, 2023)

4. **Left vas anesthesia**: Now grasp the patient's left vas using the three-finger technique. Remember to reach your left hand over the patient's abdomen to approach the vas deferens from this lateral position.
    a. The next step will be to place the left vas deferens below the anesthetized puncture site.
        - Start by placing your thumb on the top third of the scrotum while your index finger is on the middle third. (This is different from holding with three fingers on the right side.) As with the right side, place your middle finger under the scrotum to identify the duct and mobilize it to the puncture site.
        - Notice now that the thumb is above the index finger.
    b. For a right-handed operator, isolating the left vas may be more difficult and uncomfortable than isolating the right vas. It may take time and practice to master. A left-handed operator will need to reverse these positions and therefore may find it more difficult to isolate the right vas.
    c. Repeat the administration of the anesthetic as previously described.

5. After removing the needle, gently pinch the skin wheal between your thumb and index finger for a few seconds to reduce its size and soften and thin the local tissues.



Pinch of the "skin wheal" (Engender Health, 2007)

6. If the patient feels pain after the surgical procedure begins, inject an additional 0.2 to 0.3 mL directly into the vas on the painful side. Avoid creating another wheal on the skin to avoid edema in the subcutaneous tissue.

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8. VASECTOMY TECHNIQUE WITHOUT A SCALPEL

8.1 Access and exposure of the vas deferens

Although the no-scalpel technique is almost bloodless, superficial bleeding may occasionally be encountered. Be sure to maintain adequate hemostasis to help prevent the development of scrotal hematoma and subsequent risk of infection. Take all

necessary precautions to avoid cross-contamination by strictly following infection prevention rules and guidelines.

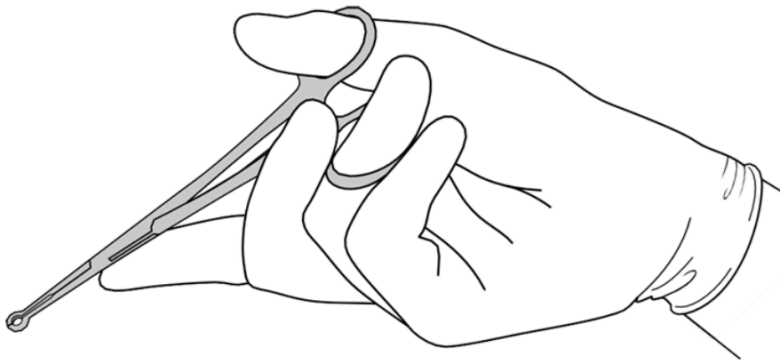
NOTE: The following instructions and accompanying illustrations are for right-handed operators. Left-handed operators may find it helpful to use a mirror when viewing illustrations designed for right-handed operators.

8.2 Use of the ring clamp

He Use of the ring clamp allows isolation and control of the vas deferens.

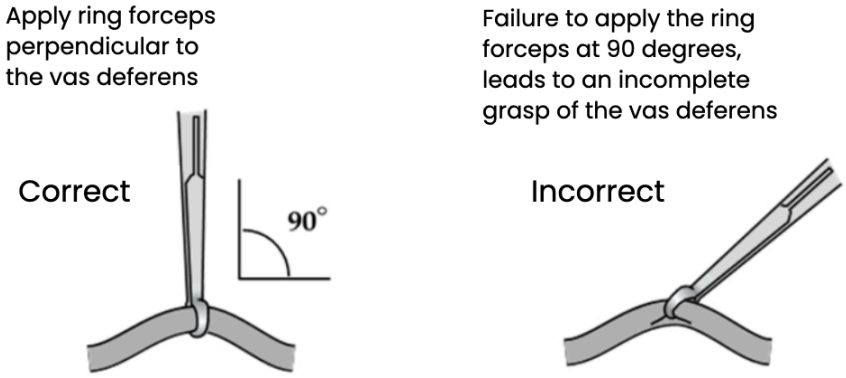
Ringed forceps for no-scalpel vasectomy (Engender Health, 2007)

1. When holding the ring clamp, it is important to remember three points:
    a. First, for greater control and precision, hold the ring clamp with your palm up and wrist extended.



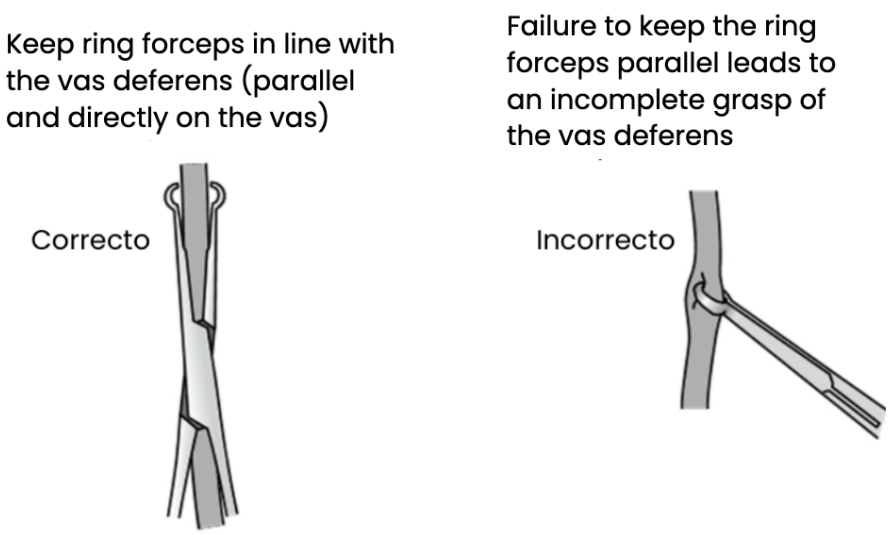
Ring clamp position (palm up) (Engender Health, 2007)

b. Second, apply the clamp at a 90-degree angle perpendicular to the vas. The palm-up hand position helps make this easier to do. Make sure that your index finger is stabilizing the body of the ring forceps (see above).



Perpendicular application of the ring clamp (Engender Health, 2007)

c. Third, hold the axis of the ring forceps aligned with the axis of the vas deferens, parallel to the vas deferens and directly above it.



Parallel application of the ring clamp (Engender Health, 2007)

2. If you don't follow the three points above, the clamp may not secure the vas completely, or it may grab too much skin. The ring forceps should surround the entire vas deferens.

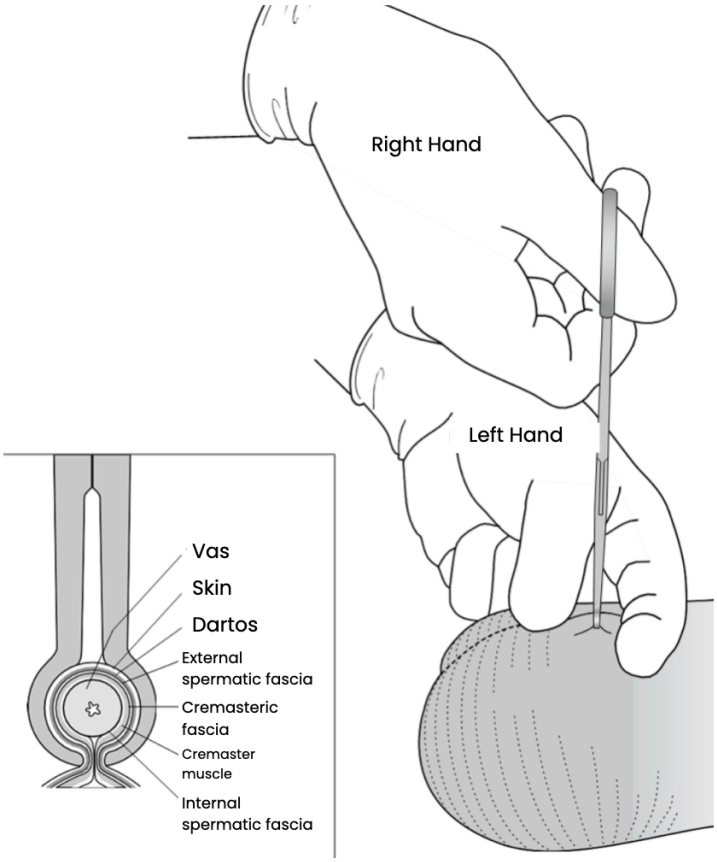
8.3 Application of the ring forceps on the scrotum and right vas

Using the three finger technique (described above), stretch firmly the skin that covers the vas deferens, where the needle entered for the infiltration of the anesthesia. The skin should be as thin as possible.

Scrotal skin access for vasectomy should be located to provide access to the straight portion of the vas deferens. Higher openings allow better access to the straight portion of the vas, facilitate cauterization of the lumen of the vas deferens (see below), and create a longer vas segment on the testicular side of the vasectomy.

Apply the ring clamp, as described above, with the axis at a 90-degree angle perpendicular to the duct.

1. Open the ring forceps and press the tips onto the skin immediately overlying the canal (see below).
2. Apply upward pressure with your middle finger under the scrotum to resist the downward push of the ring clamp and press the duct from below toward the ring.
3. Slowly and gently close the clamp around the vas deferens, until the first click.



Application of the ring forceps around the vas deferens (Engender Health, 2007)

Avoid two potential issues when applying the ring clamp:

1. Be sure to raise your middle finger under the scrotum. Otherwise, the finger will give way under the downward pressure of the ring clamp and you will have difficulty stabilizing the vas.
2. Do not grab too much skin with the ring forceps. Doing so will make it difficult to dissect and remove the vas deferens and may cause slight bleeding. The skin should be stretched over the vas deferens just before applying the ring clamp. If you grab too much skin, stabilize the vas deferens with your left hand, between your thumb and index finger, and then loosen the clamp slightly without releasing it completely. Use the fingers of your left hand to release some of the skin from the grasp of the forceps, while maintaining the grip of the forceps on the vas deferens. Then secure the ring forceps again only to the first click of the instrument.

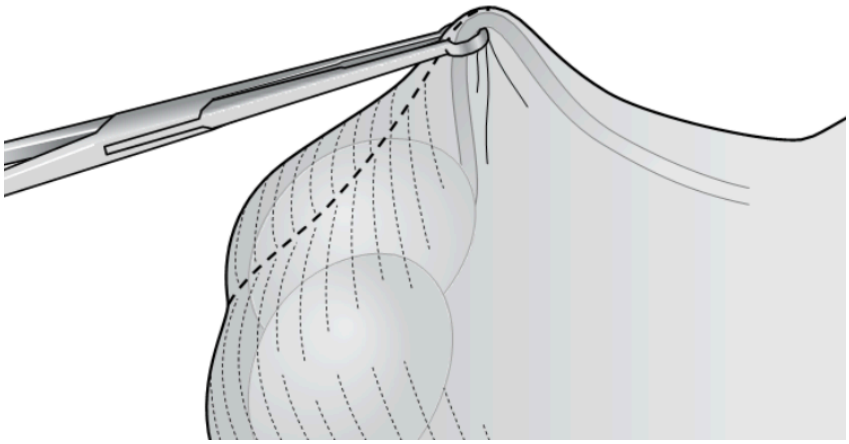
Instead of the tight skin technique described above, some surgeons apply the ring clamp in a different way when they are first learning the no-scalpel vasectomy.

1. With the ring clamp in the right hand, the surgeon gently pinches the skin of the scrotum with the ring clamp, intentionally surrounding more skin than is grasped with the tight skin technique.
2. Using the left hand, the surgeon removes excess tissue from the tips of the ring forceps. The surgeon may want to use this alternative if he or she is having difficulty isolating just the vas deferens.

8.4 Elevation of the underlying right vas

While the ring clamp is still grasping the skin of the scrotum and the underlying right duct, lower the handles of the ring clamp. This causes a curvature in the vas (see below).

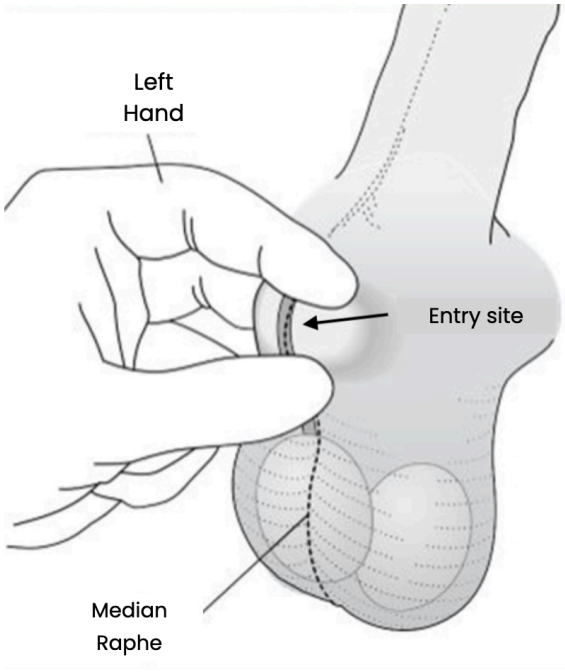
This movement elevates the vas deferens. Continue to keep the axis of the clamp aligned with the longitudinal axis of the vas.



Elevation of the vas held in the ring clamp (Engender Health, 2007)

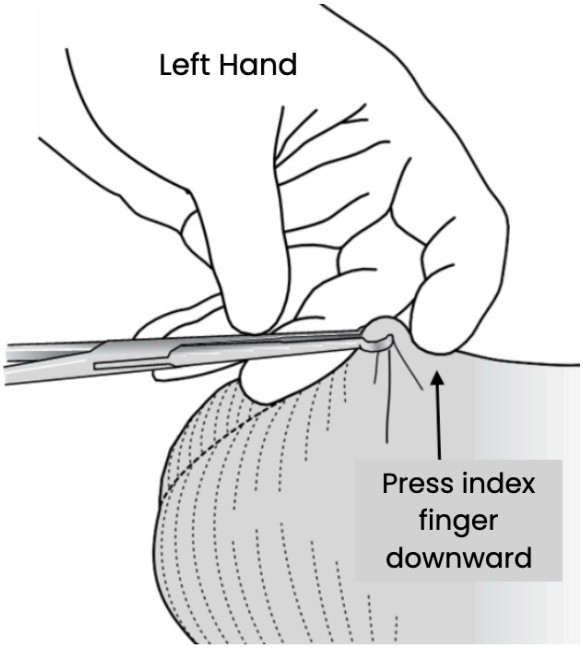
8.5 Scrotal skin perforation

1. The skin must be pierced in the area previously anesthetized, halfway between the top of the testicles and the base of the penis (see below).



Entry site for scrotal piercing (Engender Health, 2007)

Using your left index finger, press lightly down to tighten the scrotal skin just in front of the tips of the ring clamp and over the anesthetized area.



Left index finger pressing slightly down (Engender Health, 2007)

2. Hold the dissecting forceps (Li forceps) in the right hand, with the tips curved downward, in preparation for perforation of the vas deferens.
    a. Hold the instrument so that there is a 45-degree angle between the closed tips of the forceps and the vas.
    b. Then open the clamps. Using only the medial blade (blade near your left hand) of the forceps, pierce the scrotal skin just above the upper edge of the ring forceps, where the vas is most prominent (see below).

Scrotal piercing with the medial blade of the Li clamp (Engender Health, 2007)

    c. This perforation should result in a midline puncture of the vas deferens, preferably at the point where the needle entered for anesthetic infiltration.
        i. When performing the puncture, do not slowly push the dissecting forceps forward. Instead, use a single, quick, controlled motion to puncture the skin down to the vas deferens.
        ii. Advance the medial blade of the forceps toward the lumen of the vas.

3. Avoid the following mistakes when piercing the skin of the scrotum:
    a. Be sure to penetrate the anterior wall of the canal with the dissecting forceps. Otherwise, the intact overlying fascia will prevent elevation of the vas deferens out of the puncture wound.

b. If the puncture is too deep, a section of the vas deferens may occur and the artery in the vas deferens may be damaged, causing bleeding.
c. Be sure to pierce the vas deferens just above the top edge of the ring forceps. If the puncture is performed in the tissue that is grasped with the ring forceps, it will not be able to spread the tissues properly.

4. After performing the puncture, remove the medial blade of the dissecting forceps. Close the tips of the instrument.

5. At the same 45 degree angle as before, insert both tips of the forceps in the same puncture hole, on the same line and at the same depth as when performing the puncture with the single blade.

Insertion of both tips of the Li forceps (Engender Health, 2007)

6. The ring clamp remains in place and locked while the skin is pierced.

8.6 Extension of the tissues

Gently open the tips of the dissecting forceps transversely along the vas to create an opening in the skin that is twice the diameter of the vas (see below).

Extension of the tissues with both tips of the Li forceps (Engender Health, 2007)

In one motion, spread all layers of tissue from the skin to the vas deferens. The tips of the forceps should penetrate deep enough to expose the bare wall of the canal. No harm occurs if it enters the lumen. Take care to keep the closed blades of the dissecting forceps parallel to the vas deferens.

The skin and duct sheath will remain open after the tissues are extended. In contrast, the opening of the vas deferens will close after extending. As it closes, the puncture site in the vas deferens may appear as a longitudinal groove. The stretched opening in the skin and sheath, which should be twice the diameter of the vas, will allow you to lift a handle of the vas.

The ring clamp remains in place and locked while the tissues are extended.

8.7 Extraction of the right vas

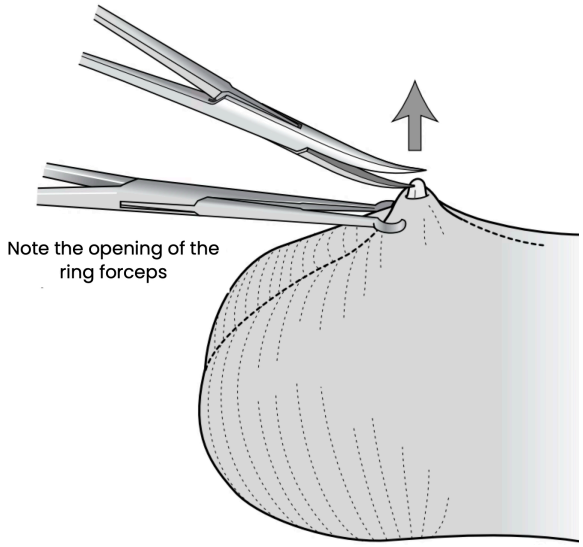
Remove the dissecting forceps from the puncture hole. With the tip of the lateral blade (blade away from left hand) of the dissecting forceps facing down, pierce the wall of the vas deferens at a 45 degree angle. Using of the lateral blade allows the operator to rotate the wrist more easily.

Puncturing vas deferens with medial blade of Li forceps

With the lateral blade inserted into the vas deferens and the ring forceps still holding the scrotal skin, rotate the handle of the dissecting forceps clockwise 180 degrees so that the tips move upward, to form a loop of the vas deferens.

Li Clamp 180 Degree Turn (Engender Health, 2007)

While rotating the dissecting forceps with your right hand, slowly release the ring forceps with your left hand, allowing the Li forceps to elevate the vas through the puncture hole.



Simultaneous release of the ring forceps during the rotation and elevation of the Li clamp (Engender Health, 2007)

This simultaneous rotation with one hand and release of the ring clamp with the other requires practice and coordination. At the beginning of the rotation, your right hand will be palm down. After the hand rotation, it will be with the palm facing up.

If the vas deferens is difficult to remove, the sheath may need to be extended further.

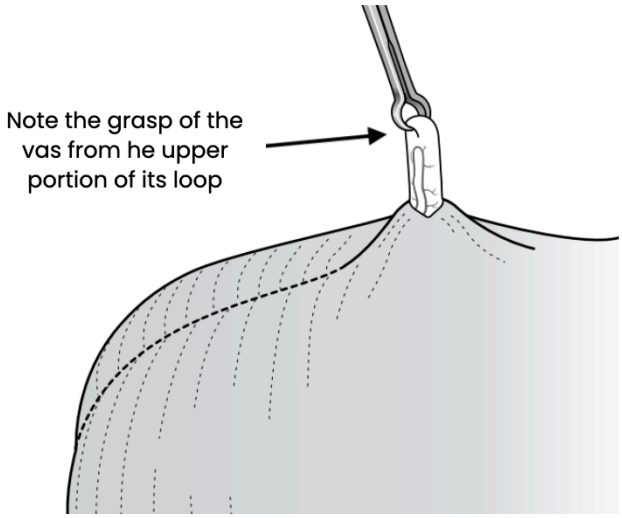
Pay attention to these possible drawbacks:

1. Do not attempt to remove the vas deferens while the ring clamp is still locked. If you do, the vas deferens may be cut.
2. If fascial tissue is trapped between the tips of the Li forceps, you will not be able to rotate or elevate the vas deferens.

8.8 Grasping the vas deferens with the ring forceps

Once a loop of the vas deferens has been secured and extracted, close gently the Li forceps on the vas deferens to prevent it from sliding back toward the scrotum while removing the ring clamp from the skin.

Then grasp the loop of the vas by bitting it through a partial thickness of its wallwith the ring forceps. Sometimes you will see a groove in the vas, created when the it was was punctured.



Grasping the vas deferens loop (Engender Health, 2007)

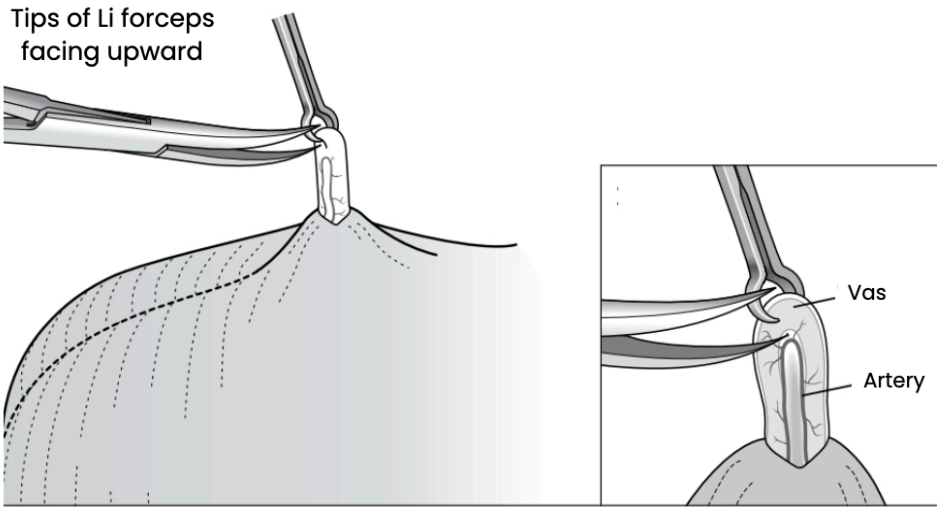
After a partial thickness of the vas has been grasped, release the dissecting forceps.

Be aware of the following potential hazards when holding the vas with the ring clamp:

1. Be careful not to release the dissecting forceps until you have grasped a portion of the vas deferens loop with the ring forceps. This will prevent the vas deferens from slipping back into the scrotum.
2. To avoid damaging the arterial supply of the vas, be sure to grasp it by the ridge on the top of the loop. Grasping elsewhere leads to asymmetrical detachment of the vas sheath.
3. Grab only part of the thickness of the duct. If the ring clamp is placed around the entire circumference of the vas deferens, it may slide back into the scrotum when it is divided.

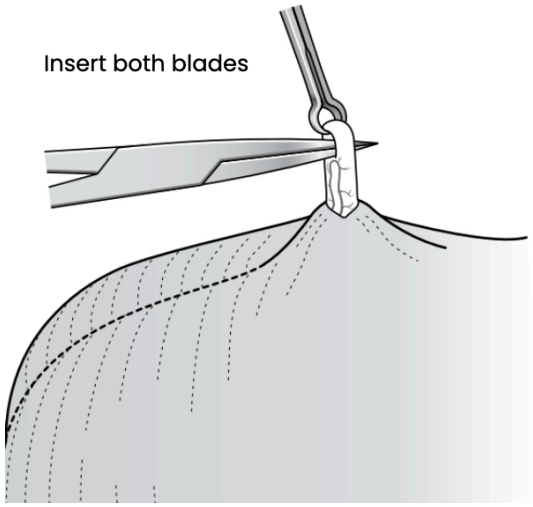
8.9 Separation of the fascia and vasculature of the vas

Using one tip of the dissecting forceps (tips facing up), gently pierce the vas sheath just below the loop, taking care not to damage the artery (see below). Pus the tip gently through the sheath halfway the length of the blade. You will have created a small window over the posterior aspect of the loop of the vas. Then remove the tip.



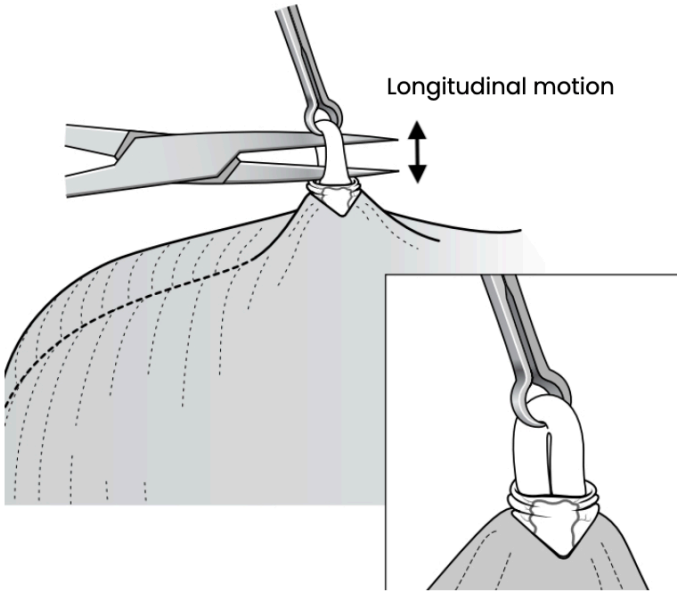
Separation of fascia and vas vasculature (1) (Engender Health, 2007)

Close the tips of the dissecting forceps. Now, insert both tips (with tips facing side) into the perforated sheath.



Separation of fascia and vas vasculature (2) (Engender Health, 2007)

Carefully open the dissecting forceps (see below). Peel the sheath and surrounding tissues downward, for at least 1 cm in length of the vas. This is a longitudinal movement, not a transversal one.



Separation of fascia and vas vasculature (3) (Engender Health, 2007)

Be careful to avoid blood vessels. Clamp or cauterize any bleeding immediately. When checking for bleeding, pay special attention to the abdominal segment of the vas deferens, which is where bleeding from the vas deferens artery could occur (a common reason for hematoma formation).

From this moment on, the occlusion technique described below in this document is applied.

8.10 Isolation and removal of the left vas

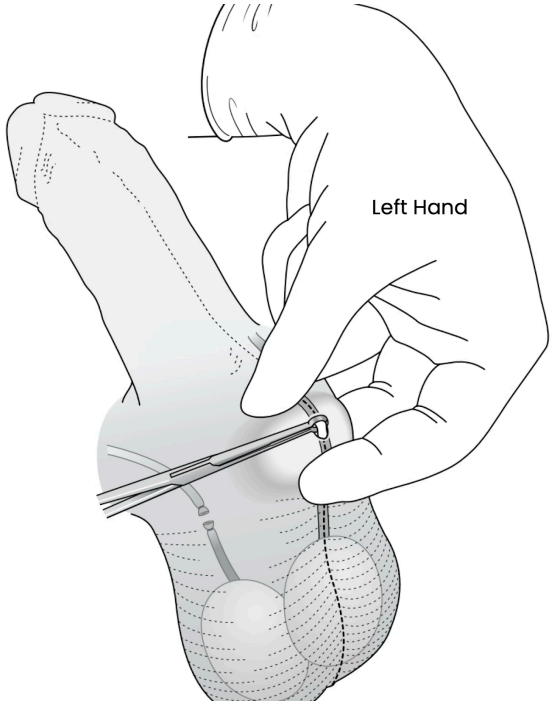
Adjust your left hand to grasp the left vas deferens, using the three-finger technique. As described above, place your middle finger under the scrotum, with your thumb and index finger above the scrotum. Place the vas directly below the previously opened puncture site.

This position may be uncomfortable at first, but with practice the skilled operator will be able to isolate the left vas as gently as the right. Holding the vas with the left hand frees the right hand to manipulate the instruments (vice versa for the left-handed operator).

8.11 Application of the ring clamp for the left vas

Again using the three finger technique, stretch firmly the skin that covers the vas deferens so that it is as thin as possible. Open the ring clamp and press the tips downward.

To expose the vas deferens through the puncture site. Lock the clamp around the vas and overlying sheath. As with the right vas deferens, and as explained previously, use the “palm up” approach to ensure that the instrument is applied perpendicular to the vas deferens (90 degrees).



Exposure of the left vas deferens (Engender Health, 2007)

Occasionally, the sheath and underlying canal cannot be clamped due to local edema. Insertion of the clamp into the scrotal tissue may increase the risk of trauma and infection. However, if the vas deferens is directly below the puncture hole, inserting the forceps into the scrotal tissue will likely not contribute to trauma or infection.

If the operator searches for the vas deferens blindly, with the ring clamp inside the scrotum, the risk of trauma and infection is likely to increase.

Grasping the left vas deferens and its sheath directly with the ring clamp can make the vasectomy easier to perform, particularly when the scrotal skin is thick.

8.12 Extraction, elevation and dissection of the left vas

Follow the steps previously described for the right vas deferens.

9. Vas Deferens Occlusion Technique

Below are the steps for occlusion of the vas deferens using cauterization of the prostatic (abdominal) end of the vas deferens, and the interposition of the perivasal fascia. These are performed in the same way for both vasa deferentia.

Remember that occlusion of the vas deferens is more easily performed in the straight portion than in the convoluted portion of the vas.

1. Once the vas is exposed outside the scrotum as described above, completely separate the sheath of the exposed segment of the vas (Figure 1).

Figure 1. *Open the Li forceps to separate the sheath (Labrecque, 2011)*

   a. Be sure to grab only part of the thickness of the vas deferens. Do not go around the vas deferens with the ring forceps. Otherwise, control of the vas deferens will be lost when it is cut.

b. The length of the bare vas segment does not need to be that long. When removing the sheath, open the blades of the dissecting forceps by 3 to 5 mm.

2. Perform a hemi-transection of the prostatic end of the bare vas, midway between the teeth of the ring clamp and the remaining vas sheath (Figures 2 and 3). This can be done with the iris scissors or by activating the thermal cautery.

Figure 2. *Hemi-transection of the vas deferens with scissors (Labrecque, 2011)*

***Figure 3**. Hemi-transection of the vas deferens with thermal cautery device (Labrecque, 2011)*

   a. The cut should be deep enough to expose the lumen of the vas, but the posterior wall of the canal should remain intact.

3. Insert the tip of the cold cautery into the lumen of the vas in its prostatic direction. Then, place it parallel to the canal while fully inserting the tip into the lumen.
   a. Verify that the device is working properly before starting the procedure. The tip should turn red when the device is turned on.
   b. Do not insert the tip into the lumen when the device is turned on. The tip should be cool when inserted.
   c. Hold the device as if it were a pencil and stabilize it with the thumb of the other hand.
   d. Make sure the tip is inside and parallel to the lumen before turning on the device.

4. Turn on the cautery device for 2 to 3 seconds, until the vas begins to become opaque or vapors appear (Figure 4).

Figure 4. *Cauterization of the epithelium, inside the lumen of the prostatic segment of the vas (Labrecque, 2011)*

   a. Be careful not to burn the vas deferens too much. Only the epithelium should be destroyed, not the muscular wall of the vas.
   b. The time of cauterization varies depending on the power of the battery. Cauterization with fresh alkaline batteries may take only 1 second.
   c. The tip can get stuck in the vas deferens. Gentle traction on the tip with a twisting motion should help pull the tip out of the lumen.
      i. It may help to turn on the device for another second while you take it out.
      ii. Be careful not to burn excessively the vas.

5. Completely transect the vas using the iris scissors or activated cautery device (Figure 5).
   a. Complete the cut exactly at the site that was hemi transected.
   b. Do not apply traction on the ring clamp (the testicular stump) while cutting the duct. Traction can cause the prostate stump to slide too deeply into the scrotum.

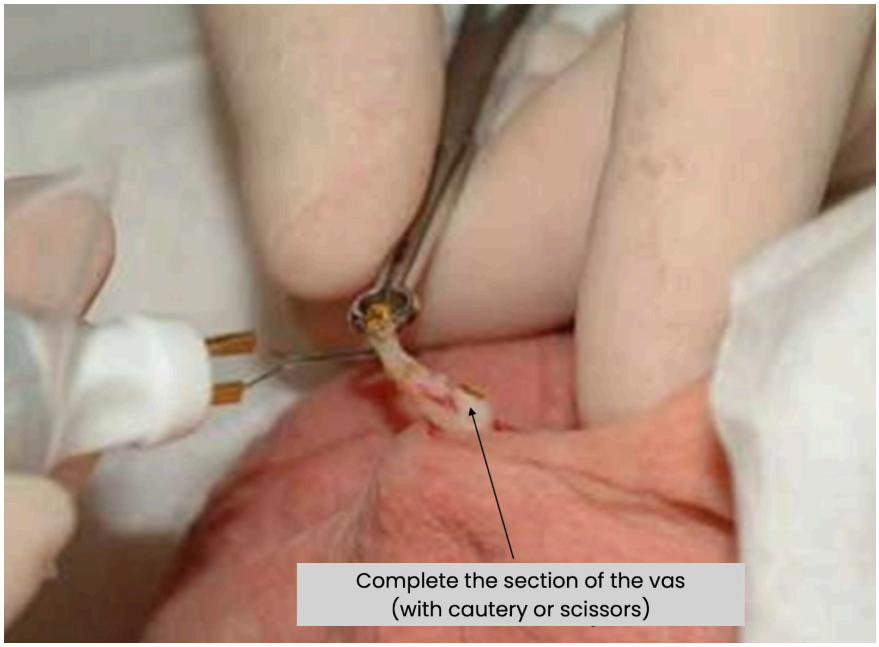


***Figure 5**. Cutting the vas with the thermal cautery device (Labrecque, 2011)*

6. To cover the prostate stump, use hemostatic forceps (mosquito) or dissecting forceps (Li forceps) to grasp the full thickness of the sheath midway between the place where the fascia attaches to the segment of the testicular duct and the prostatic stump. (Figure 6).

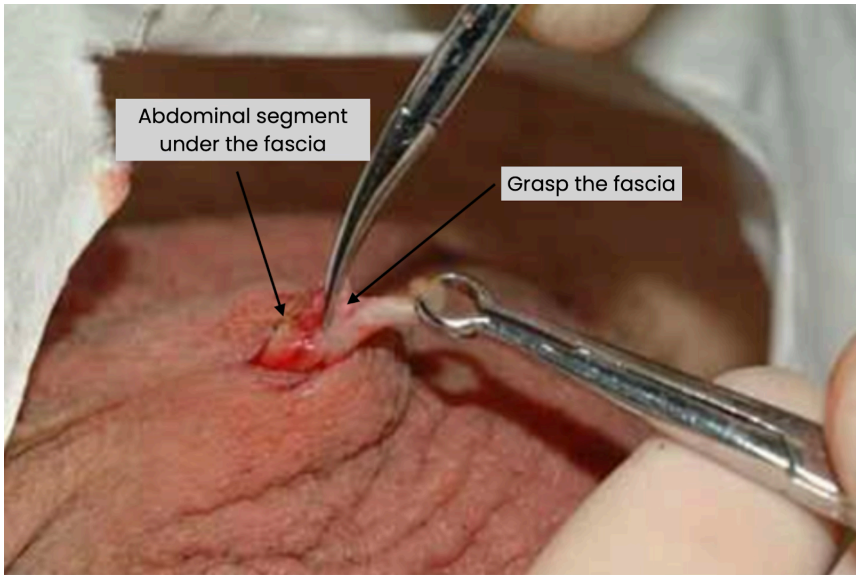


***Figure 6**. Grasp the internal spermatic fascia with dissecting forceps (Labrecque, 2011)*

c. If the prostate stump does not slide spontaneously into its sheath, do one of the following until the vas deferens slides into its sheath:
    i. Ensure that the posterior wall of the vas deferens (including its sheath) has been completely transected by very gently making an additional cut with the cautery device. After a proper transection, a loop will no longer be observed (Figure 5, above).
    ii. Gently use the hemostat to push the prostate stump into its sheath.
    iii. Pinch the fascia over the stump with your thumb and index finger.
d. When grasping the fascia, be sure to grasp both sides of the sheath to cover the prostate stump.
e. Gripping the fascia too high or too low prevents complete and adequate coverage of the stump.

7. Holding the fascia firmly with the Li dissecting forceps or mosquito forceps, gently remove the testicular end to separate 2-3 mm of the fascia covering the testicular segment (Figure 7). This step is essential to ligate a portion of the fascia covering the testicular stump along with the fascia covering the prostate stump to perform a proper fascial interposition (FI) (see next step below).

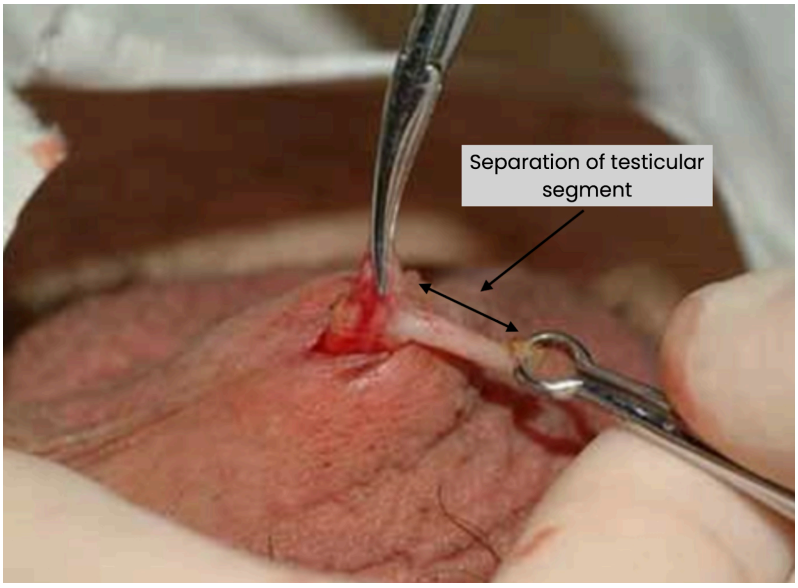


Figure 7*- Pull the testicular stump to separate the sheath that covers the testicular stump (Labrecque, 2011)*

8. Place a free tie of 2-0 or 3-0 silk (or other suture material) with at least 3 knots on the fascia overlying the prostate stump (Figures 8 and 9).
    a. Make sure that a portion of the fascia covering the testicular segment is tied over the prostatic stump.
    b. Vessels can be ligated concomitantly to control bleeding.
    c. Be sure to ligate only the fascia and not the prostate stump.
    d. Fascial ligation can help to fully push the prostate stump into the fascia if this was not adequately achieved in Step 7.

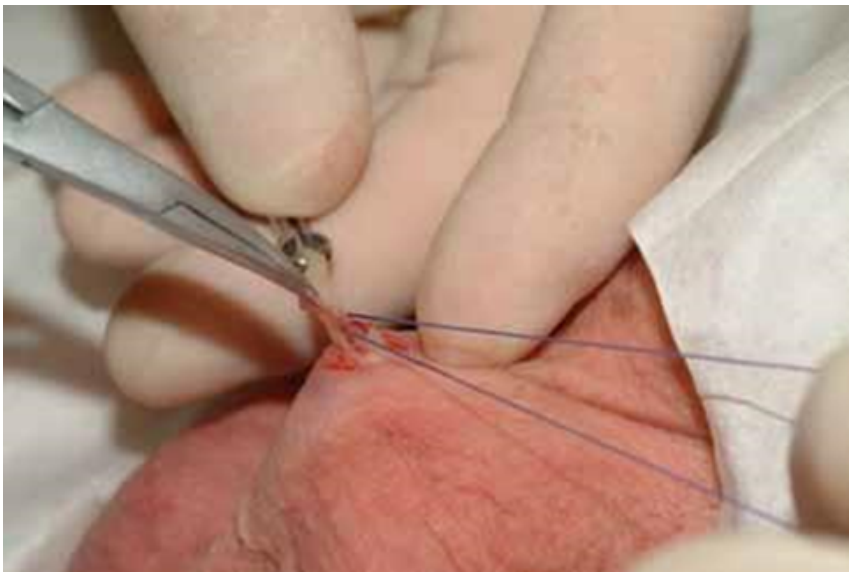


Figure 8. *Ligate the fascia on the prostatic stump (1) (Labrecque, 2011)*

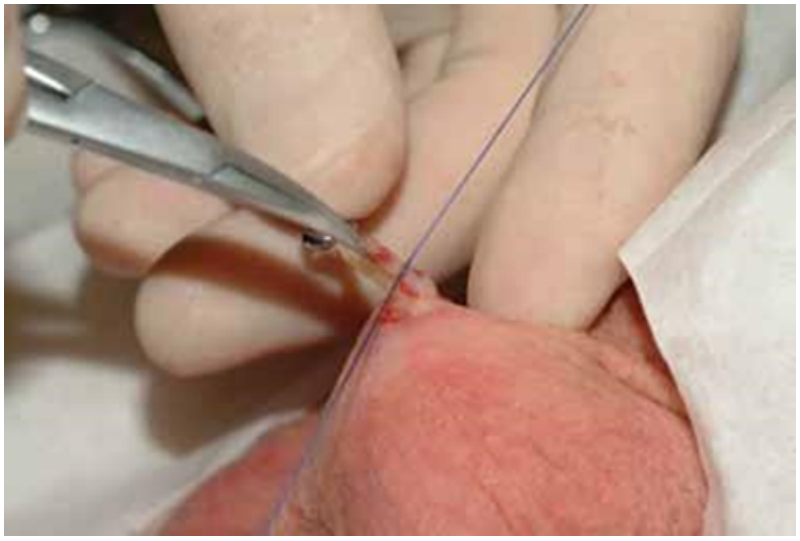


***Figure 9**- Ligate the fascia on the prostatic stump (2) (Labrecque, 2011)*

When optimal fascial interposition is performed, the abdominal (prostatic) segment of the vas deferens will be completely covered by fascia. At the same time, the tension generated by the suture applied to the fascia should create a small indentation (notch or collar) around the base of the exposed testicular segment of the vas deferens (see below).

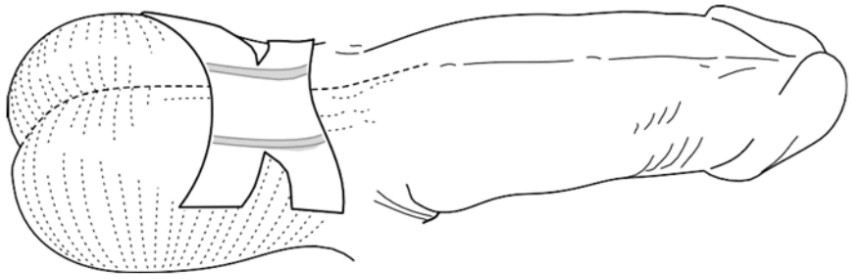
Indentation at the base of the testicular segment (Guarín, 2020)

9. Cut the sutures.
    a. Remember that the testicular end will be left open (this is called *open-ended vasectomy*) after having completely cut the duct as indicated above.
    b. Open-end vasectomy is the technique of leaving the testicular end of the divided vas unoccluded while the abdominal end is occluded. The hypothetical objectives of this technique are:
        i. Prevent or reduce post-vasectomy pain by reducing backward pressure on the epididymis
        ii. Allowing a sperm granuloma to form at the severed testicular end of the vas deferens, which some experts speculate could increase the chance of success of potential future vasectomy reversal.
        iii. When an open vasectomy is performed, fascial interposition (FI) is used at the prostatic (abdominal) end of the transected vas to prevent recanalization.

10. Before letting the stumps of the prostatic and testicular vas slide into the scrotum, carefully check for bleeding.
    a. Use the cautery device to control minor bleeding.
    b. A suture over the fascia at the base of the testicular segment can control persistent bleeding.

11. Repeat the procedure in the contralateral vas deferens.

12. Bandage the wound
    a. After both vasa have been occluded and returned to the scrotum, pinch the puncture site tightly for around 30 to 60 seconds, or have the client hold a gauze and apply pressure himself. Inspect for bleeding.
    b. If bleeding occurs, hemostasis must be achieved.
    c. Sutures are not necessarys on the skin. A sterile gauze bandage can be held in place with a scrotal support or tape such, or a band-aid can be used to cover the small wound.



Applying a bandage to the surgical wound (Engender Health, 2007)

10. Histological evaluation

Remember that segments of the vas deferens are not routinely removed in the technique described here. If any part of the vas deferens is removed, a routine histological examination is not routinely required.

Although there is no evidence for or against routine histological examination of any excised segment of the vas deferens, the *American Urological Association* has recommended in multiple occasions that histological confirmation of the vas deferens is not required as a measure of vasectomy success, since post-vasectomy semen sampling (PVSA for its acronym in English) is the determinant of the success of the procedure.

Histological examination of the resected vas deferens segments, as a determinant of vasectomy success, does not provided added value for it to be requested routinely. Only at the discretion of the surgeon, it may be useful to send excised tissues for histological evaluation and confirm the vasal tissue.

II. POST-OPERATIVE CARE

Explain to the patient in plain language how to care for the wound, what side effects to expect, what to do if complications occur, where to go for emergency care, and when and where to return for a follow-up visit. Tell your patient that minor pain and bruising that does not require medical attention might be expected.

The patient should seek medical attention if they have a fever, if blood or pus comes from the puncture site, or if they experience excessive pain or swelling. Provide a brief, written summary of the instructions.

It is essential that the patient be informed of the low probability of vasectomy failure. The patient should be emphatically reminded that it is necessary to use another method of birth control for the first 12 weeks after the procedure, and until the result of a semen analysis has been reported, to avoid an unplanned pregnancy.

1. Tight underwear

The patient should wear supportive underwear immediately after the procedure to reduce any pain or discomfort caused by tension on the spermatic cord. This support should continue until the patient is comfortable without it.

Mild swelling and pain are common for a few days. The patient can take oral pain relievers as recommended by his or her doctor.

2. Ice application

Application of ice compresses to the scrotum after surgery is optional. In general, the patient should keep the surgical site clean and dry, but showers may be permitted the day after surgery, including gentle washing of the surgical site with soap and water.

Swimming or bathing in a tub of water should be avoided for three to five days.

3. Return to physical activity

In the absence of severe discomfort, patients can return to non-physical work on the day of the vasectomy or the day after.

The patient should be given access to the physician or his/her staff and instructed to call if unusually severe pain, excessive bleeding or drainage, excessive swelling, redness, fever, or any other problem of concern to the patient.

Physical work or recreational physical activity may be resumed when pain tolerance allows.

Time off from work appears to be based on several factors, including type of job, day of the week of the procedure, and patient preference.

4. Resumption of sexual activity

Men usually resume sexual intercourse after the first week after a vasectomy.

Studies have confirmed the lack of sexual problems in men after vasectomy. In general, for the vast majority of men who undergo vasectomies, there are no negative effects on sexual function. Many patients are concerned that vasectomy may cause changes in sexual function, such as erectile dysfunction, reduced or absent orgasmic sensation, decreased ejaculate volume, reduced sexual interest, decreased genital sensation, and/or decreased sexual pleasure. Patients can rest assured that there is no evidence that any of these problems are caused by the vasectomy.

5. Postoperative evaluation

A postoperative visit with the surgeon specifically for a physical examination of the scrotum is not routinely necessary. The results of the post-vasectomy sample (PVSA) and/or the need for one or more additional PVSAs may be reported by telephone or other modes of communication.

6. Post-vasectomy semen sample (PVSA)

A semen sample, 12 weeks after the procedure, is used to confirm the effectiveness of a vasectomy.

The effectiveness of vasectomy can be defined as **contraceptive efficacy** and **occlusive efficacy**. The standard definition of contraceptive efficacy is the absence of pregnancy. The standard definition of occlusive efficacy is post-vasectomy azoospermia. However, some men fail to achieve azoospermia after vasectomy and still never father a

pregnancy. Therefore, the definition of occlusive efficacy should not be limited to azoospermia, but should include those men whose PVSA show rare nonmotile sperm (RNMS), defined as ≤100,000 sperm/mL and no sperm motility.

6.1 Vasectomy failure

Vasectomy failure is the occurrence of pregnancy or the failure to achieve azoospermia or RNMS after a reasonable period of time after vasectomy.

Vasectomy failure may be a technical failure resulting from a surgical error, such as occluding one duct twice without occluding the other duct or failing to identify the very rare situation of duplication of the duct on one side. A technical failure is characterized by persistently normal or near-normal motile sperm counts after vasectomy.

Vasectomy failure may also be due to recanalization at the vasectomy site. Recanalization after vasectomy should be suspected if motile sperm or increasing sperm concentrations are observed after a PVSA routine has shown azoospermia or RNMS. Recanalization can be transient or persistent depending on the results of PVSA serially.

Pregnancy due to recanalization is estimated to occur after approximately 1 in 2,000 vasectomies or less frequently.

6.2 Analytical techniques PVSA

If the doctor sends samples of PVSA to a commercial laboratory, the doctor must request that the laboratory perform the PVSA *without centrifugation* because centrifugation can reduce or eliminate sperm motility.

The doctor should also ask the laboratory to report both the *presence or absence of sperm* as well as the *presence or absence of motility* of the sperm. If only immotile sperm are present, the doctor should ask the laboratory to report the number of immotile sperm per milliliter. If no sperm are found in the uncentrifuged sample, the laboratory should ideally report that the presence of sperm is “below the limit of detection,” although most laboratories report “azoospermia” in this situation.

6.3 Elimination of motile sperm

The elimination of motile sperm is much faster than the elimination of immotile sperm. Recent studies confirm that when cautery (MC) and fascial interposition (FI) are combined to occlude the vas deferens, essentially all motile sperm disappear within five

to six weeks and only 1% of men continue to show motile sperm. Between 7 and 14 weeks, this proportion drops to 0.4% and more than 14 weeks after vasectomy, no motile sperm are observed.

Men and their partners should use other methods of contraception until the PVSA confirms the success of the vasectomy. During the first few weeks after a vasectomy, sperm remaining in the male reproductive system, on the abdominal side of the vasectomy site, may retain the ability to fertilize an egg.

6.4 Sample analysis

The World Health Organization (WHO) guidelines (2010) recommend that the semen analysis to assess motility be performed within 60 minutes of ejaculation, when the semen sample is provided in the laboratory.

If a man is unable to ejaculate in the clinic, then delivery of a semen sample to the laboratory should occur within one hour after ejaculation so that motility assessment can be performed during the second hour after ejaculation.

Semen samples should be transported at room temperature (between 20° and 37°C). In most semen samples, sperm motility does not decrease within one to two hours after ejaculation.

III. COMPLICATIONS OF VASECTOMY

As with any surgical procedure, there are possible complications during and after a vasectomy.

It is important not only to fully inform the patient about the potential risks of the procedure, but also to establish an adequate communication channel that allows the patient to access the surgeon to discuss questions or concerns that allow early identification of possible complications.

Surgical complication rates after a vasectomy are approximately 1 to 2%. The most important predictor of complications after the procedure is case volume and the surgeon's experience.

1. INTRAOPERATIVE COMPLICATIONS

1.1 Syncope

Definition

Clinical syndrome in which a transient loss of consciousness occurs, caused by a period of inadequate cerebral blood flow and oxygenation, most often as a result of an abrupt drop in systemic blood pressure.

- Syncope: Temporary and self-limited loss of consciousness.
- Pre-syncope: Clinical manifestations suggesting impending syncope.

Recognition

High preoperative anxiety and noxious stimuli, such as the sight of blood, the smell of cauterization, or the mere thought of a vasectomy, can trigger an episode.

In some cases it is perceived as a sudden panic attack, due to the subsequent adrenergic discharge.

The patient may feel weak and nauseous. It may appear diaphoretic, pale and cold in its prodromal phase. You may even faint briefly, with spontaneous recovery of consciousness.

Management

Prevention:

- Talk to the patient before the procedure about their fears to reduce their anxiety.
- Set appropriate expectations before starting the procedure.
- Avoid discussing unnecessary surgical details with anxious patients, as this may accelerate their stress response. Limit yourself to providing the minimum information required during the procedure.
- Maintain an ongoing conversation with the patient about topics unrelated to the procedure.
- Avoid sudden motions (e.g. when examining the scrotum, tying the suture, etc.)
- Identify prodromal symptoms early.
- Be sure to use techniques sensory distraction when performing sudden procedures that may overstimulate the patient (for example, applying light pressure to the skin of the scrotum with the fingers just before inserting the anesthetic needle).

- Reduce external noise
- Have soft music, or music to the patient's taste.
- Involve the partner in the conversation, if they are present.

Treatment:

- If the patient experiences symptoms:
    - Recognize them and calm him down (For example, *“I see you're not feeling well. It is common not to feel comfortable in these situations. The procedure is going well and without problems”*)
    - Don't minimize what the patient is experiencing. avoid saying *"Calm down, this is nothing"*.
    - Don't rush to finish. Maintain the pace of the procedure. Rushing can cause sudden motions that can accelerate symptoms and take the patient from a presyncopal episode to syncope.
    - Remember, if present, that the patient's partner may be concerned when seeing the patient with these symptoms. Sometimes a partner can also help minimize the symptoms.
    - Demonstrate calm and control of the situation.
- Use sensory distraction techniques:
    - Application of cold compresses to one side of the patient's neck (see image of chemical reaction cold compresses below). This causes an increase in vagal tone, which can counteract the symptoms of sympathetic activation perceived by the patient.
    - When the patient becomes diaphoretic, it may be helpful to use a handheld fan over the patient's face.
    - Suggest maintaining a consistent breathing pattern. Avoid hyperventilation. Allow them to remove their mask (if they have one).
    - Use strong odors to stimulate and distract the patient (for example, alcohol, eucalyptus, cloves, coffee, cinnamon)
    - Reclining the patient (reduces hydrostatic pressure and facilitates cerebral perfusion)
    - Elevation of the lower extremities (if possible) to increase venous return.

Instant cold compress. It creates an endothermic reaction by internally mixing ammonium nitrate and water. Let it cool for a short time (20-30 min). Alternatively, use an ice pack.

- In case of syncope:
  - Keep calm
  - It is usually self-limited (less than 1-2 min)
  - Assess the patient's vital signs (blood pressure, pulse, respiratory rate, and oximetry)
  - Check with the patient about previous episodes.
  - Consider a brief neurological examination and determine if it is reasonable to continue the procedure (if it occurs before starting)
  - Have the patient wait comfortably in the clinic for 10-15 minutes at the end of the procedure, until the reaction disappears naturally, after which they will be fine again. Offer a glucose load (e.g. sugary drink, chocolates, etc.)

1.2 Persistent bleeding

Definition

Bleeding is a common complication of any surgical procedure. This bleeding can occur at the time of the vasectomy or as a late complication after the procedure.

It is not necessary to obtain coagulation studies (or other laboratories) preoperatively. Before the procedure, talk to the patient about his fears and reduce his anxiety.

Management

Prevention:

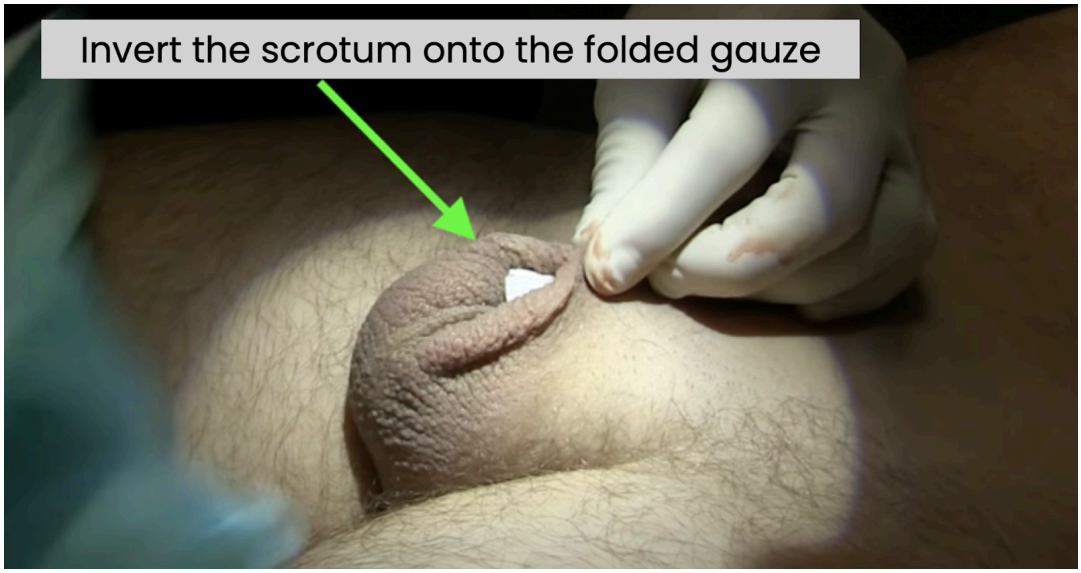
- Perform the procedure in a minimally invasive way (incision equal to or less than 10 mm in diameter)
- Avoid rough handling of the spermatic cord.
- Avoid inserting the ring clamp to attempt to exteriorize the vas deferens blindly. This could damage underlying structures and make it easier to develop delayed bleeding.
- Separate and displace only the necessary amount of fascia (along with the vas deferens) from the vas deferens to avoid trauma to the vessels.
- Remind the patient to maintain minimal activity for the first 48 hours after surgery.

- Maintain a secure grip on the fascia to prevent a bleeding vessel from falling back into the scrotum.

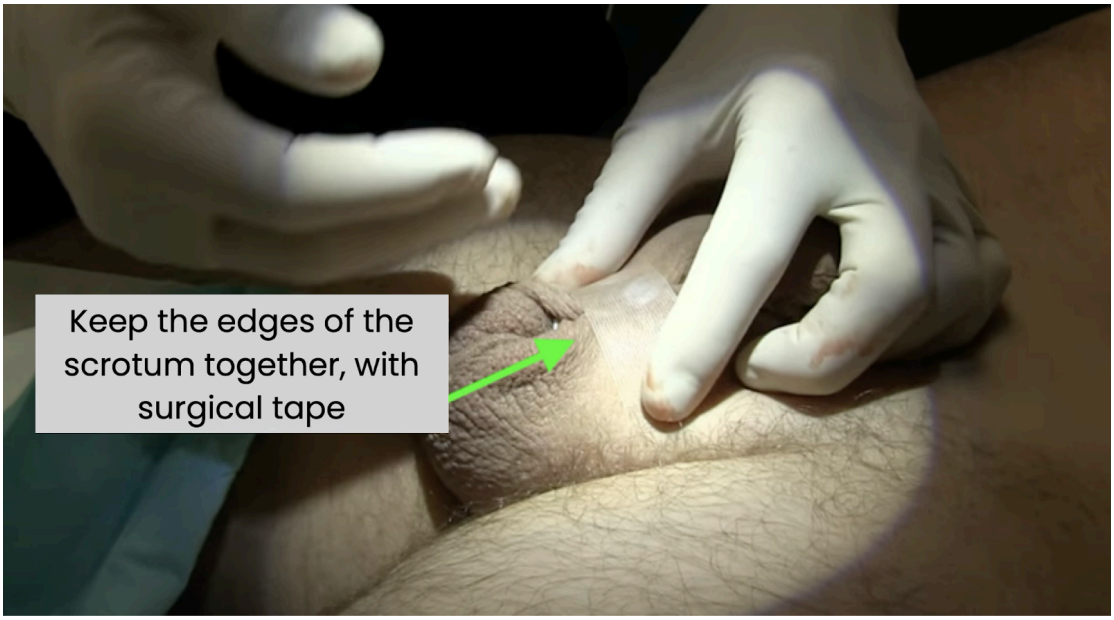
Treatment:

- If bleeding occurs at the time of the procedure:
    - Identify the bleeding vessel around the vas deferens.
    - Fix the structure with a hemostatic clamp.
    - Place a compression suture around
    - Apply pressure to the bleeding area to control subcutaneous and cutaneous bleeding.
    - Consider using thermocautery to cauterize the bleeding area (do not use “red hot” thermocautery as this may cause more bleeding. Activate the thermocautery and allow to cool slightly before applying to the bleeding area)
- Once skin bleeding is controlled, use the application of a compressive of a 4 x 4 inch piece of gauze, folded in 4, over the incision area. Remove in 24 hours. (see below)
- It is important that if there is no control of the bleeding and it is considerable, an attempt should be made to check inside the scrotum to find the source of bleeding and attempt hemostasis.

Compressive gauze to reduce bleeding (skin and subcutaneous) (1) (Labrecque, 2021)



Compressive gauze to reduce bleeding (skin and subcutaneous) (2) (Labrecque, 2021)



Compressive gauze to reduce bleeding (skin and subcutaneous) (3) (Labrecque, 2021)

- For treatment of delayed bleeding, see the hematoma section below.

1.3 Loss of one end of the vas deferens

Definition

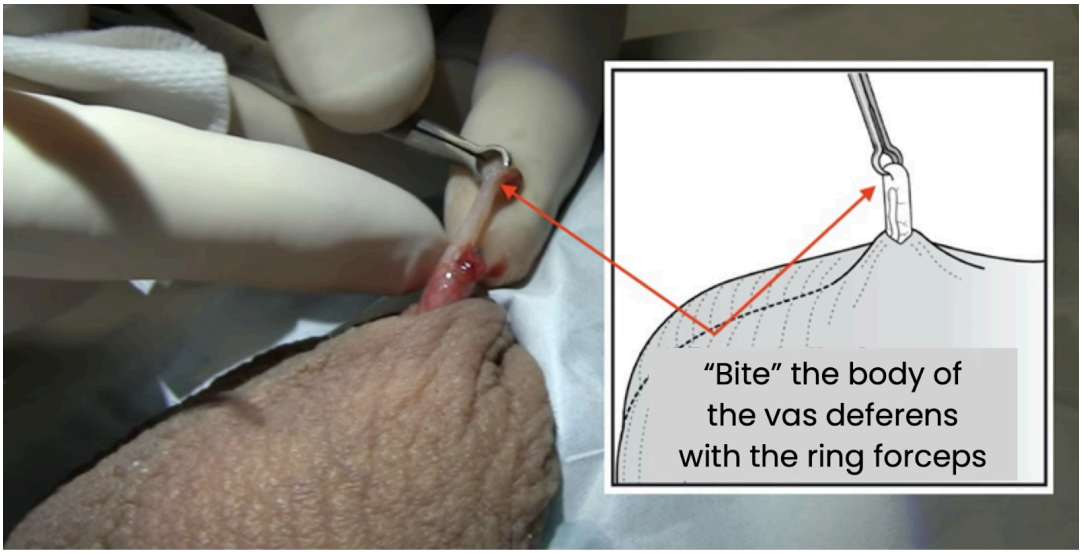
During the procedure, after one of the vas deferens has been isolated and secured, the vas may become loose from the clamp holding it. If this occurs before the vas deferens has been completely transected, then the same maneuvers performed at the beginning of the procedure to identify the vas deferens should be attempted. The vas is then extracted in the same way.

Occasionally, when transection of the canal has been completed, one (or both) ends may be released from the clamp before completing the final steps of the procedure (cauterization and fascial interposition).

Management

Prevention:

- Be sure to securely hold the vas deferens with the ring clamp. Avoid placing the clamp around it, instead “bite” the vas with the clamp to hold the segment.



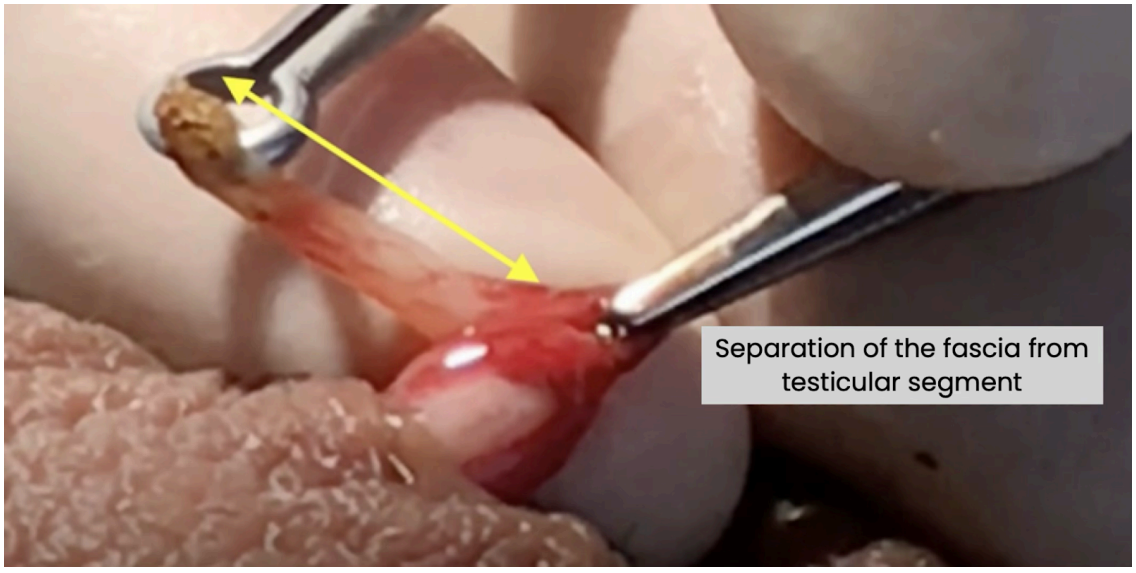
"Bite" of the vas deferens during its removal (Engender Health, 2007)

- Hold and secure the spermatic fascia with a mosquito hemostat and/or an Adson forceps.

Grasping the spermatic fascia with hemostat/Adson (Labrecque, 2019)

Treatment:

- If the vas has descended back into the scrotum before completing the intraluminal cautery (before complete division of the duct), you can attempt to identify it again using the routine “three-finger” maneuver used at the beginning of the procedure; and try to bring it under the incision.
- If successful, try lifting it again with the ring clamp or hemostat.
- If the prostatic end of the duct has returned to the scrotum toward the fascia before completing the intraluminal cautery, then proceed with interposition of the fascia and ensure that a good portion (1-1.5 cm) of the testicular end of the duct is separated from the fascia.
- If the vas deferens has fallen into the scrotum after dividing and there is obvious bleeding, an attempt should be made to remove the vas deferens again to identify and stop the bleeding.



Separation of the testicular segment of the fascia (Guarín, 2021)

1.4 Toxicity or allergic reaction to anesthetic

Definition

Local anesthetics are necessary in the practice of vasectomies for a simple and painless procedure for the patient.

It is important to keep in mind, even though ***there is no documented case*** during anesthesia for vasectomy, the potential for local anesthetic systemic toxicity (LAST).

LAST mainly affects the central nervous system and the cardiovascular system, and can be fatal.

All local anesthetics exert their effect primarily by blocking voltage-gated sodium channels (VGSCs), preventing sodium entry, subsequent depolarization, and action potential generation. This conduction block prevents the transmission of pain from neuronal cells to the cerebral cortex, thus producing analgesia and anesthesia. Toxicity occurs when cardiac sodium channels or thalamocortical neurons in the brain are affected.

Management

Prevention:

- The total dose of anesthetic administered should be the lowest dose required for the success of the procedure.

Local anesthetics for vasectomy (without epinephrine)			
	Beginning of effect	**Duration of effect**	**Maximum dose**
Lidocaine 2%	2-5 minutes	1 hour	4 mg/kg a 300 mg/dosis (15 ml 2%)
Marcaine 0.5%	5-10 minutes	2-4 hours	2 mg/kg (75 kg → 30 ml of 0.5%)

** When using needle for anesthesia, a dose of 2 ml of the anesthetic mixture is sufficient for the procedure.*

- Administer the anesthetic gradually, in 1 to 2 mL aliquots, with at least 30 to 45 seconds between injections.
- Aspirate the preinjection plunger before each incremental injection, repositioning the needle in case of blood return.

Treatment:

- Identify symptoms: vertigo, cyanosis, perioral paresthesia, seizures, cardiovascular collapse.
- Management consists of basic life support, monitoring and advanced life support (the details of this management are outside the scope of this manual).
- Consider an alternative in case of known allergy to local anesthetics
- It is ideal to consult with an allergist before the procedure, if the allergy is known in advance and available.
- In documented cases, when the patient reports it prior to the procedure, the use of 1% diphenhydramine (1-2 ml) is recommended as an alternative to local anesthesia.

2. POSTOPERATIVE COMPLICATIONS

2.1 Pain

Definition

During and after the procedure, some degree of discomfort and/or discomfort related to the intervention may occur.

The patient usually experiences, hours after the procedure, a feeling of discomfort that radiates to the abdomen, through the ipsilateral inguinal canal, from one or both sides of the scrotum. This can be described as the type of discomfort that remains after the initial acute pain of a blow to the testicular area improves.

Management

Prevention:

- Appropriate administration of local anesthetic will reduce discomfort. Make sure the patient is comfortable at all times during the procedure.
- Wearing tight underwear or a jockstrap for the first week may be beneficial.
- Limit physical activity during the first 48 hours, resuming most activities after the second postoperative day, except those that require greater effort (e.g. cycling, weight lifting, running, etc.) which should be delayed for up to a week. after the intervention. procedure.

Treatment:

- If there is pain during the procedure, additional use of local anesthetic should be considered. The procedure should not continue while the patient experiences pain, as this will cause a poor perception of the experience.
- The use of nonsteroidal anti-inflammatory drugs (NSAIDs), such as ibuprofen or naproxen, keeps most patients comfortable. If necessary, the ideal is to use them according to their half-life, by schedule and ideally for 3 to 5 days for a more consistent effect.
- Severe pain is too rare for the patient to require calling the clinic (or doctor). If this happens the patient should be evaluated, particularly if the use of NSAIDs has been insufficient or is contraindicated.
- The use of analgesic medications (for example, narcotics) is extremely rare. If its use is considered, it is suggested that the patient be seen to evaluate their condition.

2.2 Scrotal edema

Definition

Can inflammation occurs of the dermis, without redness, after vasectomy. This may be due to excessive manipulation of the scrotum during the procedure.

Management

Prevention:

- Avoid excessive manipulation of the scrotal structures when attempting to identify the vas deferens. Remember that this can not only cause discomfort and inflammation of the skin, but in turn causes increased muscle tension that could make the procedure difficult.

Treatment:

- Use of scrotal support and administration of NSAIDs (as described above).
- Alternating ice application (indirectly, over underwear or scrotal support) for the first 4 hours (apply for 30 minutes, then remove for 30 minutes).

2.3 Contact dermatitis

This should be considered in the presence of redness of the scrotum during the first postoperative day, most likely secondary to the use of the antiseptic mixture for surgical preparation.

Management

Prevention:

- Consider the use of povidone-iodine if the patient has any known allergic reaction to chlorhexidine and vice versa.

Treatment:

- The patient can clean the preparation area with a wet compress, without products. Avoid getting the incision area wet.
- Consider use of a low-potency local corticosteroid (e.g., topical hydrocortisone 1%), avoiding application directly to the surgical wound.

2.4 Scrotal ecchymosis

Definition

A purplish discoloration may appear, secondary to subcutaneous bleeding after the procedure, under the skin of the scrotum.

Scrotal ecchymosis can appear extensively, affecting the scrotum and even the base of the penis. Its presentation can occur from the first postoperative day until days later. This is painless.

Management

Prevention:

- Careful cauterization of bleeding sites under the skin, particularly at the margins of the incision.
- Applying ice, as described above, helps reduce its occurrence.

Treatment:

- If this occurs, remind him to the patient that this will not affect their health and will resolve spontaneously. Be sure to set appropriate expectations regarding the progression of its appearance (purple, yellowish, then greenish before fading).

2.5 Infection

Definition

Infections are rare. Studies, with sample sizes of more than 500 patients, have reported postoperative complication rates of infection and hematoma of 1 to 2% in most series. For this reason, the opinion of the *American Urological Association* (AUA) is that patients should be warned that the risk of hematoma and wound infection after vasectomy is approximately 1 to 2%.

The patient usually presents scrotal edema associated with erythema and pain. Fever may also appear.

Management

Prevention:

- Adequate preparation of the surgical area with antiseptic solution.
- Maintain proper sterile technique.
- Avoid prolonged surgical time and excessive manipulation.

Treatment:

- Administration of coverage antibiotics for Gram positive and Gram negative:
    - Levofloxacin (Levaquin®) 500 mg per day x 7-10 days.
    - Amoxicillin/clavulanic acid (Clavulin®) 875mg/125mg twice daily for 7-10 days.
- Scrotal support and ice administration during the first 48 hours.
- Reevaluate antibiotic response 48 hours after initiation.

2.6 Hematoma

Definition

The development of a scrotal hematoma is the most common complication encountered with vasectomy.

Studies, with sample sizes of more than 500 patients, have reported postoperative complication rates of infection and hematoma of 1 to 2% in most series. For this reason, the opinion of the *American Urological Association* (AUA) is that patients should be warned that the risk of hematoma and wound infection after vasectomy is approximately 1 to 2%.

Management

Prevention:

- Maintain adequate hemostasis at all times during the procedure.
- Remind the patient of the postoperative care instructions.

Treatment:

- The management of the hematoma depends on its progression:
    - In cases where the hematoma forms rapidly and continues to grow in the immediate postoperative period, an urgent consultation with urology may be necessary for its evacuation.
    - When the hematoma has been contained and does not continue to grow, management requires maintaining the patient's comfort with the administration of analgesics and anti-inflammatories.
- Suggest prolonged use (2 to 4 weeks) of scrotal support, along with intermittent ice administration (during the first 48 hours).
- Follow the patient to identify early the possible development of infection.
- Remind the patient that hematoma resolution may take weeks to months.

2.7 Congestive epididymitis

Definition

This presents as unilateral, although occasionally bilateral, scrotal pain along with localized pain and/or discomfort in the epididymis that may radiate to the ipsilateral inguinal area. This can be aggravated by movement.

This can occur weeks or even years after the procedure and is related to retrograde congestion of the epididymis.

The epididymis feels enlarged, swollen, and even painful.

Management

Prevention:

- Performing an “open” vasectomy (with the testicular end unoccluded) can reduce the risk of engorgement (congestion).
- This is limited and usually resolves spontaneously after persisting for 1 to 3 weeks.
- Educating and reassuring the patient about this process is essential.

Treatment:

- ***First stage (frequent 5%)***
    - Anti-inflammatory for 7-14 days:
        - Ibuprofen 600-800 mg every 8 hours, or
        - Naproxen 500 mg every 12 hours
    - Hot scrotal bath (testicles only):
        - Heat water to 116˚F/46.7˚C (not boiling) and place it inside a metal bottle (see image below).
        - Place the bottle for 45 minutes on the scrotum once a day, for 3 weeks. Warn patient to be careful to avoid burns.

Metallic bottle. Heat reduces sperm production and the congestion of the epididymis.

- ***Second stage (rare, <1%)***
    - Consider the following interventions
        - Prednisone:
            - 50 mg per day x 7 days, then
            - 25 mg per day x 7 days, then
            - 12.5 mg per day x 7 days
        - Amitriptyline:
            - 10-25 mg every day, at night x 14-30 days
        - Testosterone:
            - 200 mg intramuscularly every 2 weeks for 3 months
- ***Third stage (very rare <0.1%)***
    - Remission to urology to consider:
        - Blockage or denervation of the spermatic cord
        - Vasectomy reversal

2.8 sperm granuloma

Definition

It is an inflammatory reaction that occurs in response to the presence of sperm at the site of division of the vas deferens. Although this is common, only about 1.5% of patients report experiencing the presence of a painful nodule.

Management

Prevention:

- Due to its natural origin as a response to the procedure, there is no way to avoid it. However, it is important to provide appropriate patient education in case it occurs.

Treatment:

- Consider the following interventions:
    - Anti-inflammatory for 7-14 days:
        - Ibuprofen 600-800 mg every 8 hours, or
        - Naproxen 500 mg every 12 hours
    - Granuloma infiltration:
        - Needle 27g
        - Lidocaine 2% without epinephrine 0.5 cc + triamcinolone 40 mg/ml 0.5 cc
    - Surgical excision

IV. References

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