No-scalpel Vasectomy

No-scalpel vasectomy, or NSV or keyhole vasectomy, is a surgical method of sterilization that involves puncturing the skin of the scrotum to access the vas deferens, a tube that carries spermatozoa, or sperm, from the testes to the penis. The surgeon performing the procedure blocks the flow of sperm through the vas deferens, sterilizing the patient. NSV is a less invasive procedure, as it does not use a scalpel to make a deep cut on sensitive scrotal tissue. Typically, urologists perform NSV with the purpose of rendering the patient sterile while not altering other functions of the testes, scrotum, and penis. Li Shunqiang developed the technique in China in 1974 as a less invasive method of vasectomy for male patients. Li's development of NSV provided an alternative method to vasectomies that rely on making incisions into the scrotum with a blade. NSV gained wide use as a sterilization technique, providing a path for males to take greater responsibility for contraception and family planning.

Li Shunqiang, developed the technique of NSV in 1974. Li grew up in Chongqing, China, where his experience growing up and traveling to rural areas exposing him to farming life with large families. According to Li, he noticed the unfairness in the labor of family planning typically falling on women. Li noted families with upwards of eight children, all of whom the mothers were responsible for in addition to their farm work. He went on to work in the Fourth People's Hospital of Chongqing and study medicine, training as a surgeon. Graduating from Chongqing Medical University in 1962, Li began his work as a surgeon specializing in male sterilization. Li performed a vasectomy via incision for the first time in 1963. At the time, the majority of surgical sterilizations were on women in China, and Li found that many of his male patients were hesitant to undergo a vasectomy. He reported that his patients associated the use of a scalpel with the practice of castration. Castration is a method of sterilization that destroys the testicles and causes life-altering effects, such as permanent hormone irregularities. In accordance with his patient's fears, Li began researching methods for vasectomy that included lower risks of bruising, bleeding, and infection than traditional vasectomies.

For the next decade, Li attempted to reconcile the effectiveness and ease of vasectomy with his patients' reported concerns for their health and anxieties about the procedure. The period during which Li was researching vasectomy methods was also a time when Chinese society began to become aware of the need for population control. While the commonly known One-Child Policy did not come into effect until 1979, concerns about rapid population growth still existed in the 1960s and 1970s in China. While working at the Chongqing Family Planning Scientific Research Institute in Sichuan Province, Li developed the no-scalpel technique, and he first performed a successful vasectomy without a scalpel, hereafter NSV, in 1974.

NSV began to spread outside of China in 1985 when an international team of physicians and reproductive scientists sponsored by EngenderHealth, a US medical advocacy organization focused on equity in family planning, visited Li to learn the technique. The EngenderHealth team included Phaitun Gojaseni, who brought the technique to Thailand, and Marc Goldstein, who introduced NSV to the US. In 1986, Goldstein and Li collaborated in Bangkok with other vasectomy practitioners from South and Southeast Asia to standardize surgical training for NSV. EngenderHealth has since published three editions of an instructional surgical manual for surgeons learning to perform NSV in 1992, 1997, and 2003.

The testes, which reside in the scrotum hanging below and behind the penis, generate the sperm needed to cause pregnancy through sexual intercourse. Vasectomies sterilize people by stopping the flow of sperm through the vas deferens. Also called the ductus deferens, the vas deferens is a transport and storage duct that extends through the scrotum and pelvis into the penis and is

typically between thirty and thirty-five centimeters in length. Its primary function is to transport sperm from the epididymis, a tube extending from the testes, to the ejaculatory duct in the pelvis during ejaculation. A thin layer of muscle tissue surrounding the vas deferens aids in propelling the sperm during ejaculation. Therefore, stopping the flow of sperm through the vas deferens renders a person essentially unable to impregnate someone through sexual intercourse, making the tube a primary focus of male sterilization procedures. It is possible to find the portion of the vas deferens that passes through the scrotum by touching the scrotal area with the hand, and physicians can see images of the segment that passes through the pelvis with ultrasound. Each testis has its own vas deferens that meets with the other in the ejaculatory duct in the pelvis. When referring to both tubes, physicians use the plural vasa deferentia.

Regardless of the method, vasectomy involves surgically interfering with the vas deferens to interrupt the flow of sperm that comes from the testes and epididymis. In the surgery, the surgeon occludes, or blocks, the flow by severing or tying off the vas deferens. Before the use of NSV, surgeons would typically access the vas deferens by using a scalpel to make an incision into the middle of the scrotum, in between the testes and the base of the penis, or two incisions on either side of the scrotum. With the scrotum open and the tissues of the vasa deferentia exposed, the surgeon can occlude each vas deferens by tying, severing, and removing part of the tube, a process known as ligation and excision. To ensure the patient’s infertility, many surgeons opt to add a technique called fascial interposition. Fascial interposition involves burying one of the severed ends of the vas deferens in the sheath of tissue surrounding it. The addition of interposition decreases the need to remove more tissue from the scrotum once severing the vas deferens. Fascial interposition provides another barrier to sperm flow and inhibits the possible reconnection of the vas deferens after surgery. Other surgeons prefer to cauterize, or burn, the exposed segments of the vas deferens to block the flow of sperm. After the procedure, the testes still produce sperm, but the surrounding tissue reabsorbs the sperm cells.

Shunqiang, the inventor of the procedure, designed two proprietary surgical instruments necessary for NSV. The first is a type of ringed clamp that allows the surgeon to grasp the vas deferens through the skin of the scrotum with the ring-shaped grasping tip. There are three typical sizes of the circular tip of the ringed clamp: three millimeters, 3.5 millimeters, and four millimeters. The different sizes are available to accommodate variation in thicknesses of scrotal tissue. The second of the two main instruments is a set of dissecting forceps with curved tips. The dissecting forceps are a grasping tool that ends in two pointed tips. The forceps' sharpness and ability to open allow for the necessary steps of puncturing the tissue, stretching the tissue with the opening of the grasping arms, and grasping the vas deferens to pull it out of the skin for occlusion.

As of 2022, surgeons performing NSV still use the instruments Li developed for the procedure. In addition, surgeons also use a small syringe to deliver an anesthetic as well as supplies to occlude each of the vasa deferentia according to each surgeon's preferred method. Those supplies could include scissors for severing the vasa deferentia, additional types of forceps for fascial interposition, or electrodes to cauterize, or burn, the ducts. Auxiliary supplies such as medical tape, additional scissors, and antiseptic chemicals allow the surgeon to keep the scrotal area free of harmful contaminants and convenient to work with.

Vasectomies performed via NSV require a warm operating room, between twenty and twenty-five degrees Celsius, so that the skin and inner tissue of the scrotum may relax. Since the scrotum tends to tighten in colder environments, the warmth of the space allows for greater ease of manipulation of the scrotum, vas deferens, and surrounding tissues and helps to prevent complications from arising during and after the procedure. After sanitizing the instruments, the surgical staff or the surgeon may administer an optional tranquilizer to the patient to help them relax. Before opening the skin of the scrotum, the surgeon needs to manually grasp and isolate the vas deferens with the fingers of one hand to allow the injection of a local anesthetic, typically a lidocaine solution, to numb what would otherwise be a painful procedure. The surgeon injects the solution into the scrotal skin along the length of the vas deferens of one side of the scrotum. The lidocaine solution numbs the rest of the area affected by the surgery. After the surgeon performs the numbing step once, they repeat it for the other segment of the vas deferens on the opposite side of the scrotum.

After anesthetizing the patient, the surgeon manually isolates the vas deferens again, focusing on

the skin over the area where they previously injected the lidocaine solution. They then, with the dominant hand, use the ringed clamp to grasp the vas deferens through the skin, fully encircling the tube in the tip of the clamp. After grasping the vas with the clamp, the surgeon uses the clamp to pull back and bend the vas deferens just below the point where the skin will be punctured, which is typically midway between the base of the penis and where the tops of the testes begin. After the vas deferens is securely within the grip of the ringed clamp, the surgeon switches the grip of the clamp to their non-dominant to hold the vas deferens in place. The surgeon uses the dominant hand to work with the dissecting forceps. With the vas deferens bent toward the surgeon, they pierce the skin and front-facing outer tissue of the vas deferens with the sharp tips of the forceps. The surgeon opens the forceps' tips to stretch the skin and create an opening large enough to see the vas deferens.

Once the skin of the scrotum is open, the surgeon removes the dissecting forceps from the vas deferens and uses one of the forceps' tips to pierce into the muscle tissue surrounding the tube. They then loosen the grip of the ringed clamp while rotating the dissecting forceps to pull the bent segment of the duct through the opening in the scrotal skin. Alternatively, the surgeon can use the dissecting forceps to grasp and pull up the vas deferens without a twisting motion. Both methods deliver the vas deferens through the opening in the scrotum. The use of a small opening in the scrotal skin is the reason some refer to the procedure as keyhole vasectomy. Once the surgeon delivers the vas deferens to the surface, they fully let go of the scrotal skin with the ringed clamp and use the clamp to directly grasp the vas deferens, pulling the bent segment of the tube farther out of the opening in the skin. They then use the dissecting forceps to puncture and strip away the sheath of tissue surrounding the vas deferens.

Since NSV is only a technique meant to expose the vas deferens without significant incisions, the method used to occlude the vas deferens is up to the preferences of the surgeon and the patient. It is possible to sever and ligate the vas deferens with or without fascial interposition or to cauterize the vas deferens to occlude the flow of sperm without the full severing of the tube.

Once the surgeon has occluded both vasa deferentia, they apply pressure via pinching or pressing with gauze to each opening for a short time before washing and dressing the wounds, with simple bandages and gauze. The openings in the scrotal skin naturally shrink once the surgeon returns the segments of the vasa deferentia to the inside of the scrotum, which eliminates the need for stitches. The patient can leave after the surgeon monitors them for a short period of time, typically thirty minutes. There is mild pain and bruising expected on the scrotum for the following days. The patient can also expect to be fully sterile by roughly twelve weeks after the procedure due to lingering sperm in the system, and they can resume sexual activity whenever they are comfortable during that period.

Due to the effectiveness of the NSV technique and its proliferation, there have been various comparisons between NSV and incision vasectomy. A 1991 publication from Li and other urologists outlining the technique stated that, on average, the operation time for NSV was roughly half of the time necessary for a traditional incision vasectomy. A 1998 study of 176 military personnel in India showed a 35.7 percent decrease in operation time for NSV along with a tenfold decrease for excessive bleeding and a fourfold decrease for infection. A systematic review of multiple vasectomy studies published in 2014 reinforced the correlation between NSV and lower incidences of both infection and bleeding. Additionally, the review indicated that, generally, patients who received the no-scalpel method resumed their sexual activity more quickly than those received incision vasectomies. As of 2022, NSV remains a widely used surgical technique that allows for safer and more efficient vasectomies.

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