Transanal Minimally Invasive Surgery (TAMIS)

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Introduction

The surgical approach for rectal neoplasms has come a long way from traditional resection to minimally invasive resections. Historically surgical approaches for rectal neoplasms were radical as described by Jacques Lisfranc, Paul Kraske, and Sir William Ernest Miles in the nineteenth century [1–3]. Because of the morbidity associated with these radical procedures, surgeons started looking for less radical ways to handle rectal neoplasms. This led to the development of transanal endoscopic microsurgery (TEM) platform by Professor Gerhard Buess in 1983 [4]. This platform helped resect the rectal lesions more precisely even in the mid and upper rectum with minimal morbidity. With the advent of laparoscopy in the late 1980s, the incisions were getting smaller while the instrumentation kept getting better. By pushing the limits of laparoscopy, surgeons developed single-incision laparoscopy and all the instrumentation to go with it. Once the surgeons gained skills in single-incision laparoscopy, it was just a matter of time that this skill set and instrumentation was applied to resect rectal neoplasms. The use of the single-port technology to resect rectal neoplasms is known as transanal minimally invasive surgery (TAMIS), developed and first reported by Larach, Albert, and Atallah in 2010 [5].

Despite development of the TEM system for 30 years, it is being used only by a handful of surgeons. High initial cost, complex instrumentation, steep learning curve, and the necessity for specialized training remain significant obstacles for wider adoption [6–8]. TAMIS on the other hand is rapidly gaining popularity owing to its low cost, simple setup, and the use of traditional laparoscopic equipment [9]. TAMIS is a versatile platform, which offers several applications beyond local excision [10]. One of the most important applications for TAMIS beyond local excision is to be able to perform a total mesorectal excision transanally called TAMIS-TME [11, 12]. This is a promising new approach to facilitate distal rectal mobilization and thus represents a new era in rectal cancer surgery. The TAMIS platform has also been used in conjunction with a robotic platform to perform local excision of rectal neoplasms as well as radical proctectomy for rectal cancer [13–16]. This chapter will review the technique of TAMIS and differences to the TEM platform described in the previous chapter.

Background

The TAMIS platform can be used for benign rectal neoplasms and for well-selected T1 cancers with histologically favorable features, where the risk of nodal metastasis is low. The indication for TAMIS may also be broadened to cT0 lesions in patients with rectal cancer after neoadjuvant therapy for the purpose of confirming mural complete pathologic response (ypT0). As indicated in the introduction, TAMIS platform has been used in several nonneoplastic conditions like recto-urethral fistulas, removal of foreign bodies, and completion proctectomy [10]. The use of TAMIS in the bottom-up technique as TAMIS-TME for radical rectal resection is currently investigational.

Patient Preparation

All patients undergoing a TAMIS procedure should undergo adequate preoperative evaluation beginning with colonoscopy to rule out synchronous lesions of the colon. For malignant lesions, complete staging work-up should be performed. Careful office proctoscopy should also be performed to

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confirm tumor height and exact orientation. Inability to view the lesion in the office owing to more proximal location than thought should prompt one to consider alternative approaches. Patient selection is key for the technical success of this procedure. A lesion that is too proximal can be a higher risk for peritoneal entry with the increased difficulty of a secure closure. Conversely, a lesion that is too low can create technical difficulty during resection by limiting the triangulation of the instruments. This can be avoided by preoperative clinical examination of the lesion by the operating surgeon. Full mechanical bowel preparation and parenteral antibiotics are recommended.

Room Setup and Positioning

High Dorsal Lithotomy

The surgeon and assistant sit and view the monitor in between the patient's legs over the abdomen. The advantages of this positioning are to have access to the abdomen if the surgeon needs to perform a hybrid procedure, easy access to the patient's airway, and easy setup. The majority of lesions, if not all, can be approached this way (see Fig. 27.1).

Prone Jackknife

The surgeon and assistant stand on either side of the patient. Some surgeons favor this position for anterior lesions. One of the major drawbacks of the prone position is the difficulty managing the airway. This also means intubating the patient on the stretcher and then transferring the patient onto the operating room table, which translates into more operating room personnel and longer operating room setup time (see Fig. 27.2).

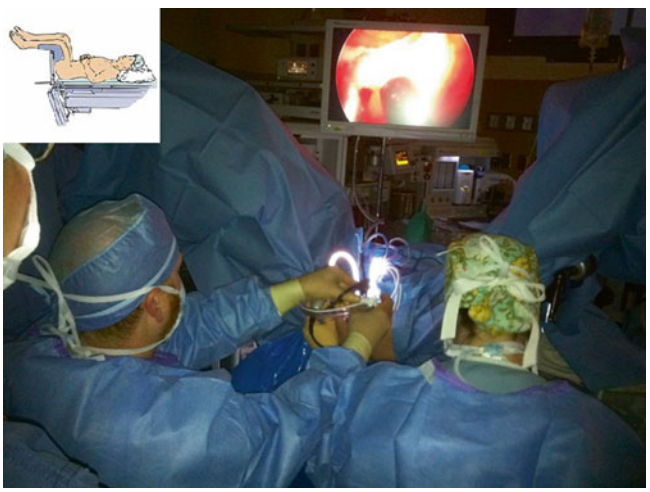

Fig. 27.1 High dorsal lithotomy position with surgeon and assistant sitting and viewing monitor in between the patient's legs

Fig. 27.2 Prone jackknife position with surgeon and assistant standing on either side of the patient

Port Setup and Instrumentation

Port Systems

Platforms approved by the Federal Drug Administration (FDA) for transanal access are the GelPOINT® Path port (Applied Medical, Rancho Santa Margarita, CA) and the SILS™ Port (Covidien, Mansfield, MA). Other access platforms that have been used are TriPort™ (Olympus, Wicklow, Ireland) system, Single-Site Laparoscopy (SSL) Access System (Ethicon Endo-Surgery, Cincinnati, OH), and the poor man's glove port (see Figs. 27.3 and 27.4).

Three working ports are available in the GelPOINT® Path port, one for the camera and two as working ports. Any of the ports can be upsized to a 12 mm port if necessary. The advantage of this setup is that the surgeon has separation of the ports to allow for triangulation of the instruments. If necessary, a fourth port can be accommodated by piercing the gel cap directly.

Three working ports are also available in the SILS™ port. This port is particularly useful in patients with a narrow anal canal. The disadvantages of this platform are increased leakage of the pneumorectum and slippage of the port due to pliability of the used material. The access ports are positioned closer, which can make the triangulation more difficult.

The Olympus TriPort™ platform has three working ports. The top of the access platform can be exchanged to a 4-port

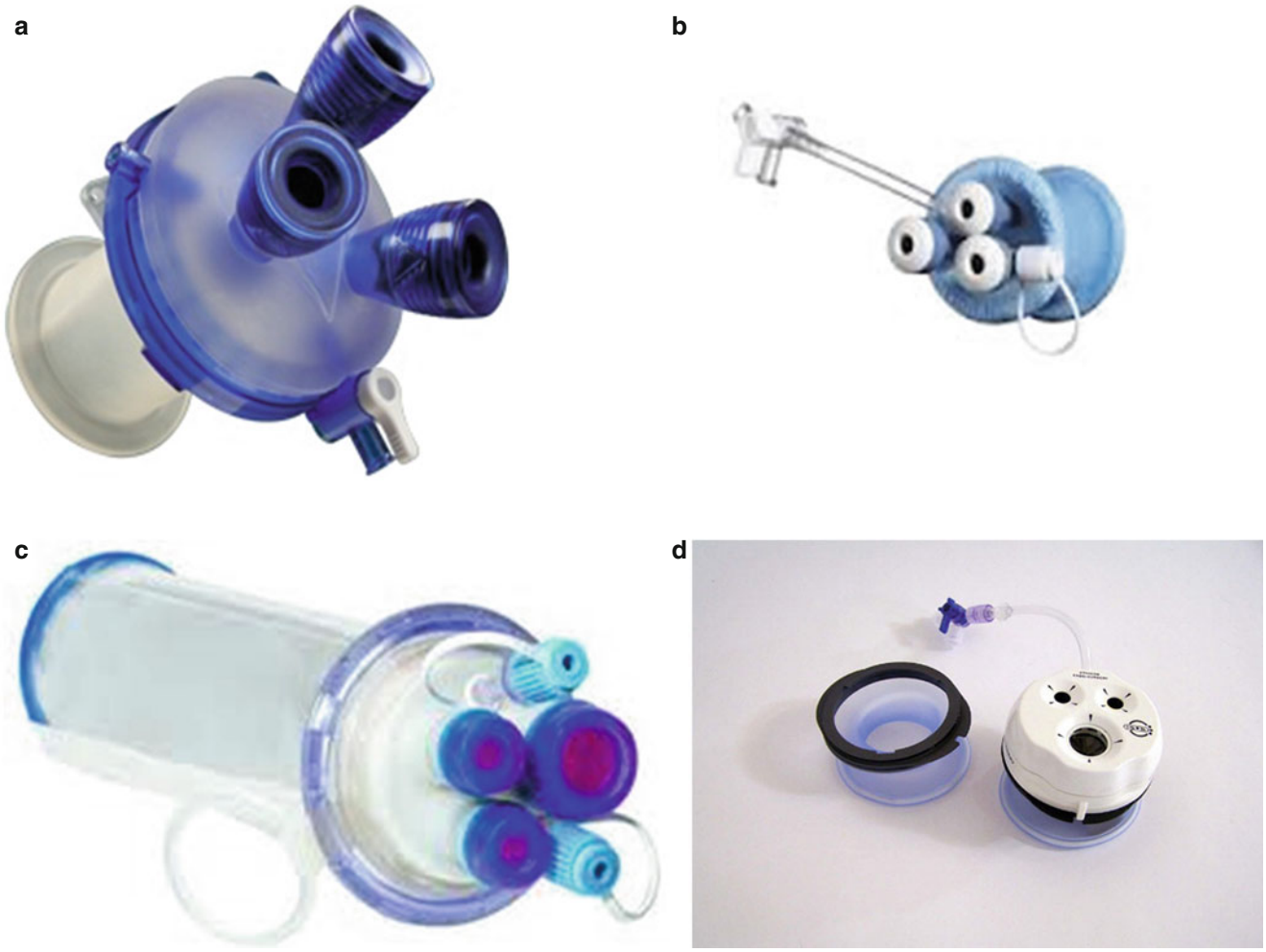

Fig. 27.3 Commercially available TAMIS platforms: SSL access system (**a**), SILS port (**b**), GelPOINT Path (**c**), TriPort (**d**)

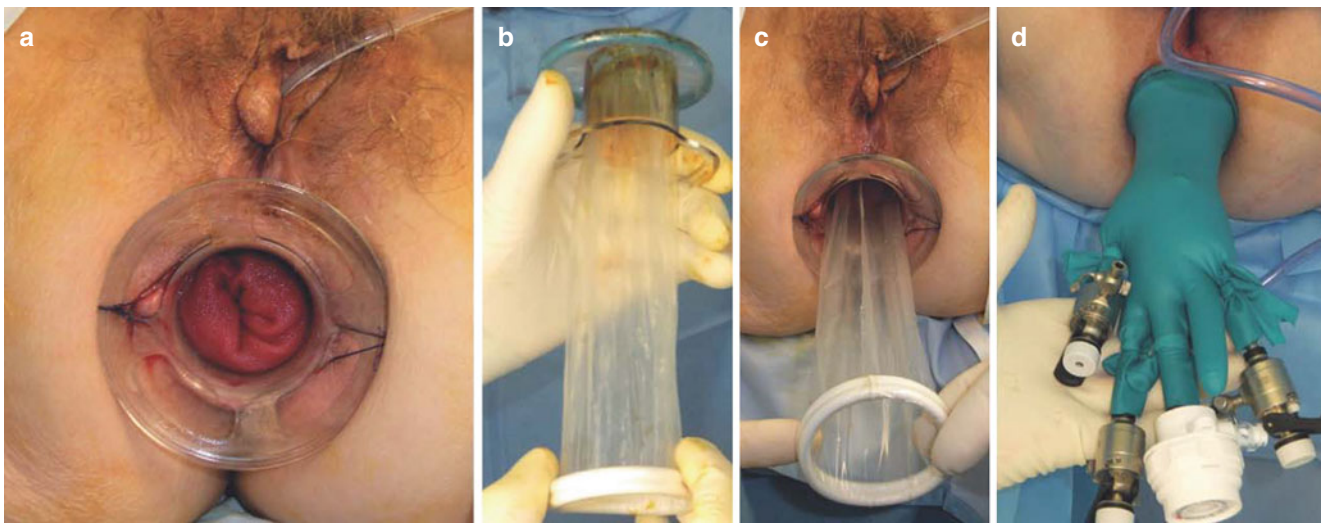

Fig. 27.4 Glove port (**a**), anal dilator in position, (**b**) wound protector after insertion, (**c**) wound protector in position, (**d**) glove port with trocar sleeves

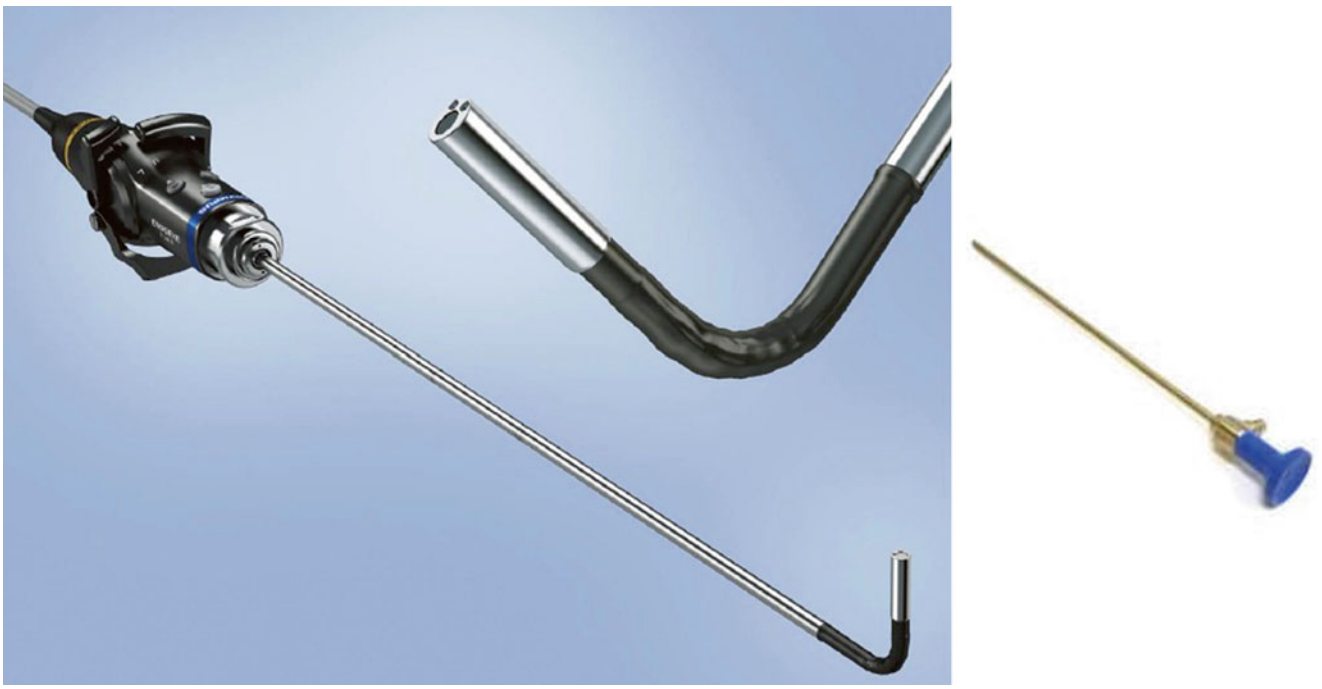

Fig. 27.5 Standard laparoscope and the Olympus EndoEYE

version if an additional port is necessary. The length of the port is adjustable and can be tailored to the length of the patient's anal canal offering a better fit and seal for the pneumorectum.

The Single-Site Laparoscopy (SSL) Access System accommodates two 5 mm instruments and one 15 mm instrument. The seal cap is designed such that the instruments can be directly inserted into the rectum without the need for trocars.

Several authors have successfully reported the poor man's glove technique [17, 18]. A disposable circular anal retractor is secured to the skin, a wound retractor is then placed into the anal retractor, and a surgical glove is placed airtight over the wound retractor. Trocars are inserted through the fingertips of the glove. This port offers a less expensive alternative to all the above platforms. Additional manual support is necessary during each insertion and extraction of instruments, making it a floating platform.

Operating Instruments

A 5 mm camera with an angled tip allows a 360-degree view of the entire circumference of the rectal wall. One of the disadvantages of using standard laparoscopes is that the light cord interferes with the working instruments. Alternatively, a 5 mm flexible tip video laparoscope, EndoEYE™ (Olympus, Wicklow, Ireland) can be used; this is a low-profile system that prevents instrument collision outside as well as inside the rectal lumen (see Fig. 27.5). A standard laparoscopic CO_2 insufflator is used to establish the pneumorectum with pressure set at 7–12 mm of Hg.

One of the working ports is used for a grasper and the other for an energy device. A 5 mm Maryland grasper is used as it provides a strong and precise grip of the specimen. The energy device can be an ultrasonic device and monopolar or bipolar cautery. Bipolar cautery and ultrasonic devices achieve excellent hemostasis but with added costs. Monopolar cautery can be used with a hook, spatula, scissors, or a needle tip, which can be bent. The advantage of using a monopolar cautery is that it can be used inside a 5 mm suction irrigator, which also aids in suctioning smoke. It also allows for a more precise plane of dissection.

Operative Steps (Table 27.1)

Table 27.1 Operative steps

Operative steps	Degree of technical difficulty (scale 1–10)
1. Establishing access and pneumorectum	2
2. Marking	2
3. Dissection and excision	5
4. Removal of specimen	2
5. Closure	7

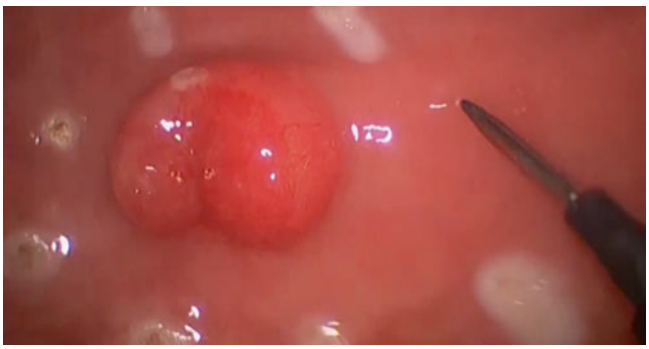

Fig. 27.6 Marking of the target lesion

Fig. 27.7 Defect in the rectum after full thickness excision including perirectal fat

Establishing Access and Pneumorectum

The anal canal should be well lubricated and dilated up to three fingers and the selected access platform should be inserted into the anal canal. The access platform should be then secured to the skin with a suture. Securing the port to the skin is an important step to provide an adequate seal for the pneumorectum and to prevent port slippage (see Video 27.1). The ports are inserted into the access channel. For the GelPOINT® Path port, the ports should be inserted into the Gel cap before securing the cap to the access channel. The handles of the instruments should be in horizontal position, away from each other to minimize instrument collision. Camera and instrument locations are dynamic throughout the procedure; they vary depending on the location of the lesion and area of dissection similar to laparoscopy. Pneumorectum is established using a standard laparoscopic CO_2 insufflator up to a pressure of 7–12 mmHg. This pressure can be increased up to 20 mmHg to achieve adequate distention. At this point, the patient should be under general anesthesia, fully paralyzed without any spontaneous breathing to prevent any bellowing of the rectum. Smoke can be evacuated with short bursts of suction to avoid loss of pneumorectum.

Marking

The lesion should be marked circumferentially using cautery to guide the margins of resection (see Video 27.2). No data currently exist regarding the benefits of 5 mm versus 1 cm margins (see Fig. 27.6).

Dissection and Excision

The preoperative assessment of the lesion will dictate the plane of dissection – submucosal, full thickness, or partial mesorectal excision (Videos 27.3 and 27.4). Handling of the tumor or polyp directly with graspers should be avoided at all costs to limit tumor fragmentation. Normal mucosa surrounding the lesion should be grasped for retraction. Dissection is started at the lower edge of the lesion and continued proximally. Anterior lesions in women should be handled with care to avoid vaginal entry. Excellent hemostasis should be achieved along the way to aid in visualizing the plane of dissection. In the event of bleeding, the camera should be kept in position with the bleeding point in view at all times, using minimal suction to dry up the blood. The surgeon should visualize the bleeding point, get control of the bleeding point using a grasper, and handle the bleeding appropriately.

Removal of Specimen

It is important to remove the specimen in one single piece with adequate margin for optimal oncologic outcomes. For benign lesions, submucosal excision is adequate, and for malignant lesions, in contrast to the historical description of a simple full-thickness incision into perirectal fat, a pyramidal volumetric excision containing an adequate specimen of perirectal fat is recommended as described by Lezoche et al. (see Fig. 27.7) [19].

Closure

If possible, primary closure of the resultant rectal wall defect should be done for all cases. Surgery in a radiated field can result in poor wound healing; surgeons should take this into consideration expecting a delay in wound healing. This can be the most difficult step of the entire procedure; hence, there are several options to accomplish the closure. Intracorporeal knot tying can be done by standard laparoscopic instruments but can be very challenging given the narrow lumen of the rectum (Video 27.5). Alternatively, an Endo Stitch™ device (Covidien, Mansfield, MA) can be used (Video 27.6). The

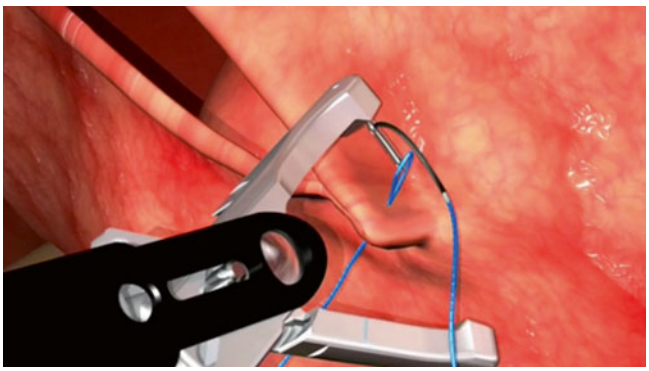

Fig. 27.8 Endo Stitch device with the v-LOCK suture

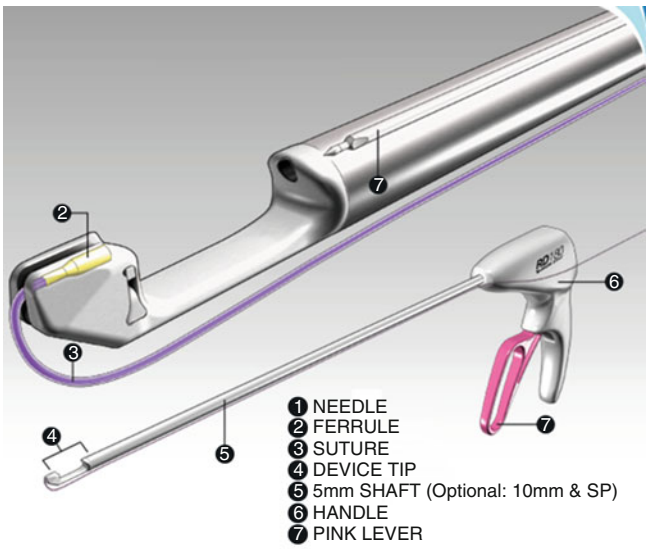

Fig. 27.9 LSI running device and knot pusher

sutures can be regular sutures, V-lock™ sutures or V-lock™ with barbed sutures (Covidien, Mansfield, MA). There is also a Running Device RD180™ (LSI Solutions, Victor, NY) that can be used through a 5 mm port to suture the defect (see Video 27.7). Extracorporeal knot tying and a knot pusher can be used in this scenario as a third option (see Figs. 27.8 and 27.9).

Summary

Dealing with any pathology in the rectum adds additional complexity because of the unique location of the rectum adjacent to vital structures and unique function of the rectum that cannot be replicated or substituted. With technology ever improving and indications ever expanding, familiarity with the TAMIS platform will be an invaluable tool in a surgeon's armamentarium.

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