Tissue Morcellation in Endoscopic Surgery

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In many surgical centers the intra-abdominal morcellation of 15-cm myomas[1] or freely dissected organs such as kidneys[2] has become routine. A prerequisite is the availability of a macro-morcellator which reduces the tissue bulk to a small enough size that it may be removed through the standard abdominal trocars in a reasonable amount of time.

HISTORICAL OVERVIEW

As early as 1977 a manually operated mechanical tissue morcellator (Fig. 1)[3,4] was available which could remove tissue specimens of up to 2 cc in one bite. Morcellation of tissue specimens of 8 cm in diameter, however, took as long as 1 to 2 hours. The SEMM Set (Serrated Edged MacroMorcellator) was introduced in 1988 in three sizes: 10, 15, and 20 mm in diameter (Fig. 2). With this manually operated instrument, tissue masses of up to 8 cm in diameter could be morcellated in 10 to 20 minutes but required great physical exertion on the part of the surgeon. This extra work caused many surgeons to perform posterior colpotomy or mini-laparotomy for removal of the tissue instead. Both of these approaches, however, constitute an additional operation, thus reducing the value of the endoscopic procedure as a purely minimally invasive procedure (MIS). After years of trials to perform endoscopic hysterectomy, the supracervical CISH (Classic Intrafascial SEMM Hysterectomy) technique[5-6] was born in 1991. In order to prevent postoperative complications including cervical stump carcinoma, it is necessary to core out the uterine mucosa completely, using a 15-, 20-, or 24-mm-diameter instrument.[7-9] Size selection depends on the diameter of the cervix. The CURT (Callibrated Uterine Resection Tool) was developed for this purpose. Based on the same principle as the SEMM Set (Fig. 2), the CURT is introduced vaginally at the beginning of the operation. This new technique after being successfully performed in numerous cases proved to be both efficient and safe. The manually operated version could now be converted to a power-driven (Fig. 3) model (WISAP-R Moto-Drive). Operative time and degree of difficulty could therefore be drastically reduced. Subsequent motorization of the SEMM Set for morcellation of myomas in its sizes 15 and 20 mm produced new problems.

The transabdominal morcellation technique which we described for the manually operated SEMM required vertical introduction of the morcellator and it was this direction of introduction that Steiner[9] recommended when using his 11-mm-diameter electromotor rotating morcellator. It has, however, been our experience since 1977 that a 10-mm-diameter instrument is relatively inefficient for the morcellation of larger tissue masses. A morcellator designed for vertical introduction and available in 10-, 15-, and 20-mm-diameter, the Automorc (Semm 1988) never came on the market because it was our belief that the vacuum-powered vertically introduced morcellator (Fig. 5) was too dangerous for widespread use.

Following initial attempts by urologists to morcellate the kidneys using the fingers,[10] an electric rotating instrument for the same purpose was introduced.[11,12] Here the kidney is placed in a "Lap-Sac." The instrument which works like a "mixer" creates a puree which may then be easily suctioned out. This type of

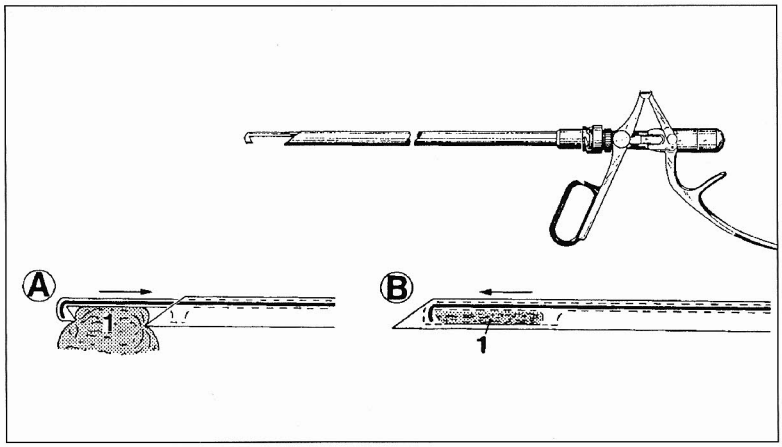

Figure 1. Tissue morcellator according to SEMM 10 mm in diameter.

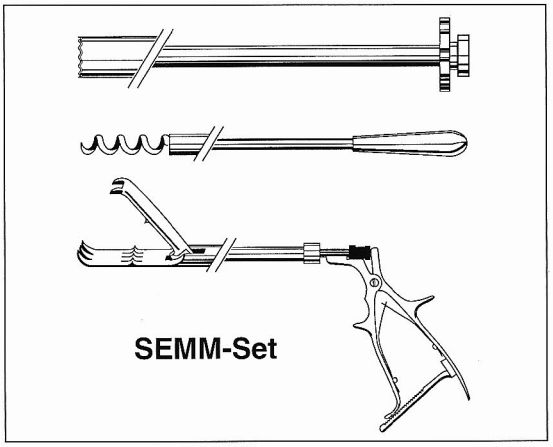

Figure 2. The Motorized SEMM Set (Serrated Edged Macro-Morcellator) consisting of the SEMM, the myoma drill, the big claw forceps, and the Moto-Drive (WISAP-R).

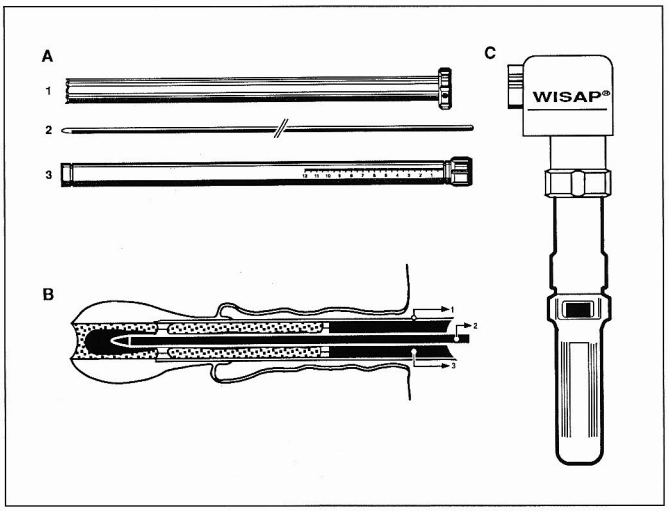

Figure 3. CURT (Callibrated Uterine Resection Tool) (a) Cutting tube in 15, 20, and 24 mm in diameter. (b) Schematic demonstration of uterine tissue excision. A cervical-uterine corpus-fundus (1, 2, and 3; see Fig. 3a) tissue cylinder is produced. (c) The WISAP-R Moto-Drive (battery operated, cordless).

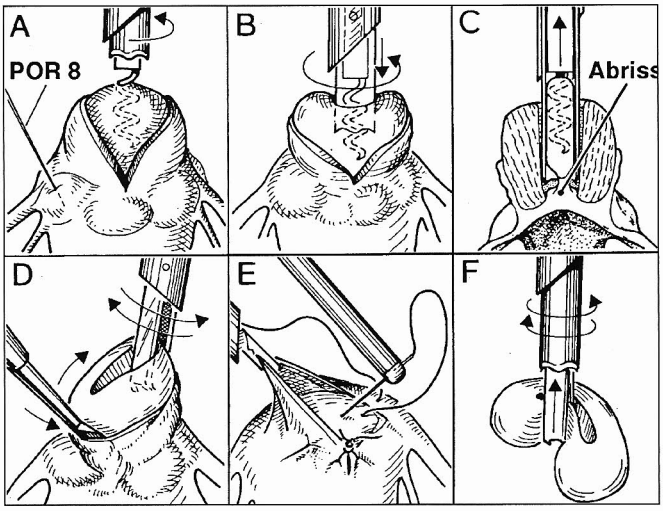

Figure 4. Myoma enucleation with vertical technique of introduction using the SEMM Set.

morcellation is, however, very disadvantageous for histologists, as highly specialized and expensive techniques are required to obtain an accurate pathological diagnosis.

In gynecology there is a great amount of discussion regarding the use of Lap-Sacs particularly for ovarian surgery.[13] When the sack is used to ensure complete removal of the ovary and its contents, the endoscopic incision must be enlarged which is not in keeping with the ideals of minimally invasive surgery. Also, should the sack burst, the resultant complications prove even more problematic than if no sack had been used.[10]

CLINICAL DEVELOPMENT

To make tissue morcellation safer, we developed the horizontal morcellation procedure as shown in Figure 6. The success and great safety of the technique prompted the development of the motorization of the SEMM in 10, 15, and 20 mm in diameter. The Moto-Drive we developed for the CURT was attached to the adapted SEMM. This is economically sound, as one motor may be used for both instruments.

The horizontal introduction lessens the complications which could occur should the instrument slip. Should the surgeon in the worst case let go of the instrument, the horizontal introduction would produce far less hazardous complications. The morcellation tube rotates very slowly and therefore may be easily observed from the perspective of optic trocar at the umbilicus. The tissue which is pulled into the rotating tube (in widths of 10, 15, or 20 mm in diameter) with a claw forceps or a myoma drill can be cut in sections up to 19 cm long (Fig. 6). This certainly justifies the term "Macro-Morcellation."

Histological examination of the specimen is performed in the usual manner without any additional preparation or work for the pathologist.

The motorized 10- to 20-mm-diameter SEMM Set adequately solves the problem of intra-abdominal morcellation. For example, a myoma 8 cm in diameter can now be morcellated in 3 to 5 minutes requiring minimal physical effort.

This instrument is also ideally suited for the intra-abdominal morcellation of kidneys which have been laparoscopically freed for removal. Fahlenkamp[2] was the first to gain experience in nephrectomy and adrenalectomy using the Steiner model. At the present time, we are working on a method to successfully combine the use of the Lap-Sac and the motorised SEMM Set.

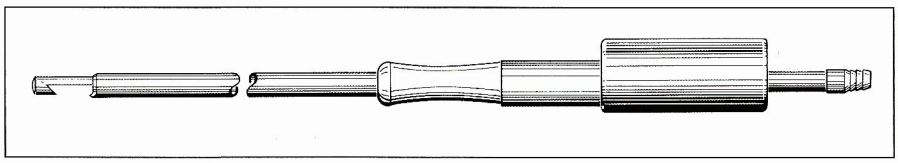

Figure 5. Auto-Morc powered by vacuum suction.

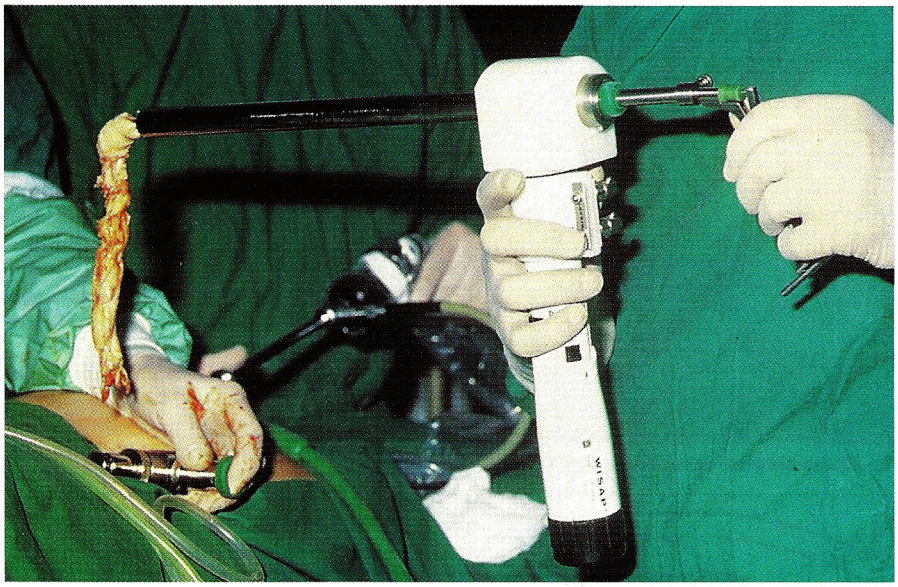

Figure 6. Extracorporeal view of the morcellated myoma being removed from the morcellator. A 18-cm-long and 2-cm-diameter tissue cylinder is shown.

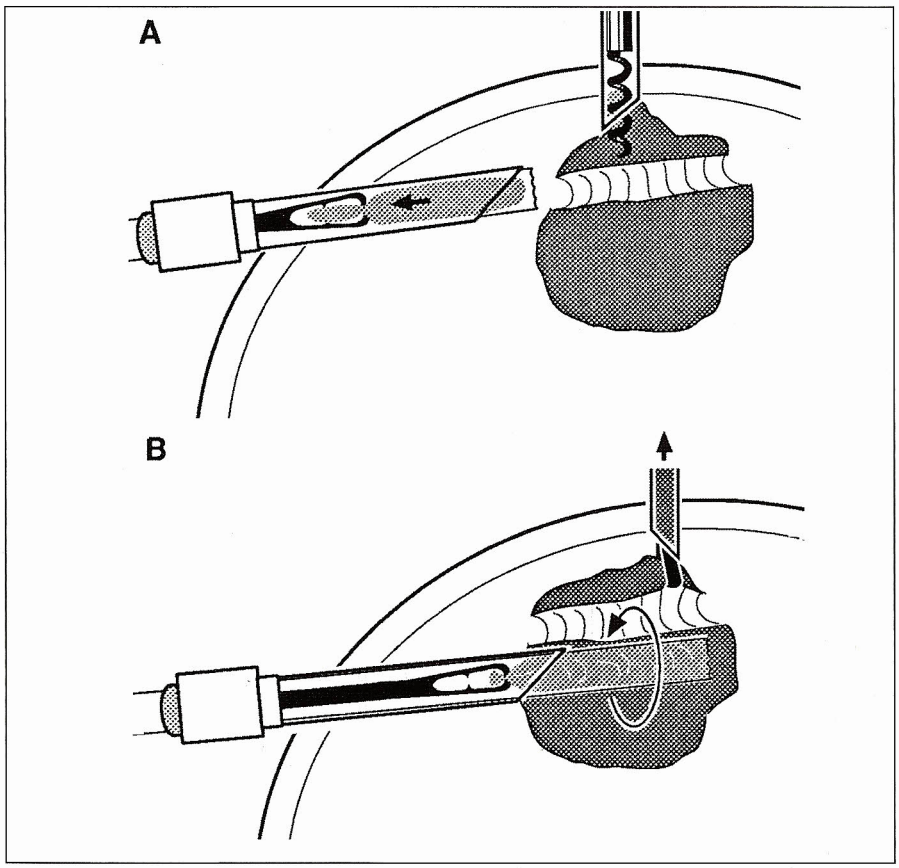

Figure 7. Schematic demonstration of the horizontal technique of introduction for myoma morcellation into 10-, 15-, or 20-mm-diameter tissue cylinders. (a) Initial excision; (b) second excision whereby a 20-mm-diameter tissue cylinder is removed.

MYOMA ENUCLEATION WITH THE MOTORIZED SEMM SET

The new horizontal morcellation technique compared to the presently used technique of vertical introduction allows for the morcellation of myomas up to 8 cm in diameter in an acceptable operative time. The battery-operated angled apparatus allows for the horizontal introduction of the serrated edged cutting tube. The rechargeable battery system also means that there is no cable coming from the instrument, which is another safety feature.

Three techniques of myoma enucleation have proven clinically successful:

1. The standard technique. The myoma is enucleated in its entirety from the uterus, the capsule is closed with sutures and the isolated myoma is then morcellated using the 15- or 20-mm-diameter morcellation tube (Fig. 8).
2. New technique of myomectomy. Taking the example of an intramural myoma, the first step involves splitting the capsule exposing two-thirds of the myoma. The myoma's mass is then reduced in situ. The morcellator is introduced in the horizontal position (Fig. 9). Only a small portion of the myoma remains which is subsequently ligated with a Roeder Loop. The hemostasis using this technique is optimal. The capsule is then closed with sutures.
3. Pelviscopic hysterectomy for large uterus myomas. Pelviscopic hysterectomy of a large uterus (e.g., uterus myomatosus) is approached in the following manner: the myoma is removed first. The base of the myoma is infiltrated with POR-8 (a synthetic vasopressin solution) in a concentration of 5 int. units per 100 mL physiological saline (i.e., 0.05 units per mL). Repeated horizontal morcellation reduces the myoma's volume so that the uterus may be safely removed using the pelviscopic hysterectomy method of choice (e.g., CISH, LAVH, or IVH).

The horizontal technique of morcellation opens new avenues in both uterus-preserving and total operations.

SUMMARY

The history of intracorporeal tissue morcellation is approximately 20 years old. At the beginning, all instruments were manually operated. Today these instruments are available with electric motors. Now the SEMM (Serrated

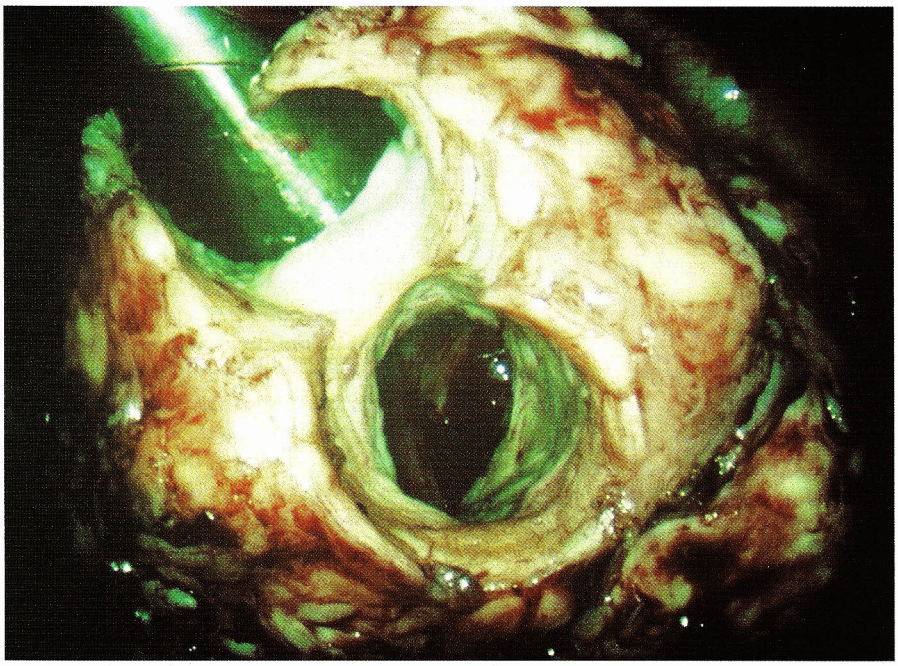

Figure 8. Slide depicting resection of a myoma using the 20-mm-diameter power-driven SEMM Set.

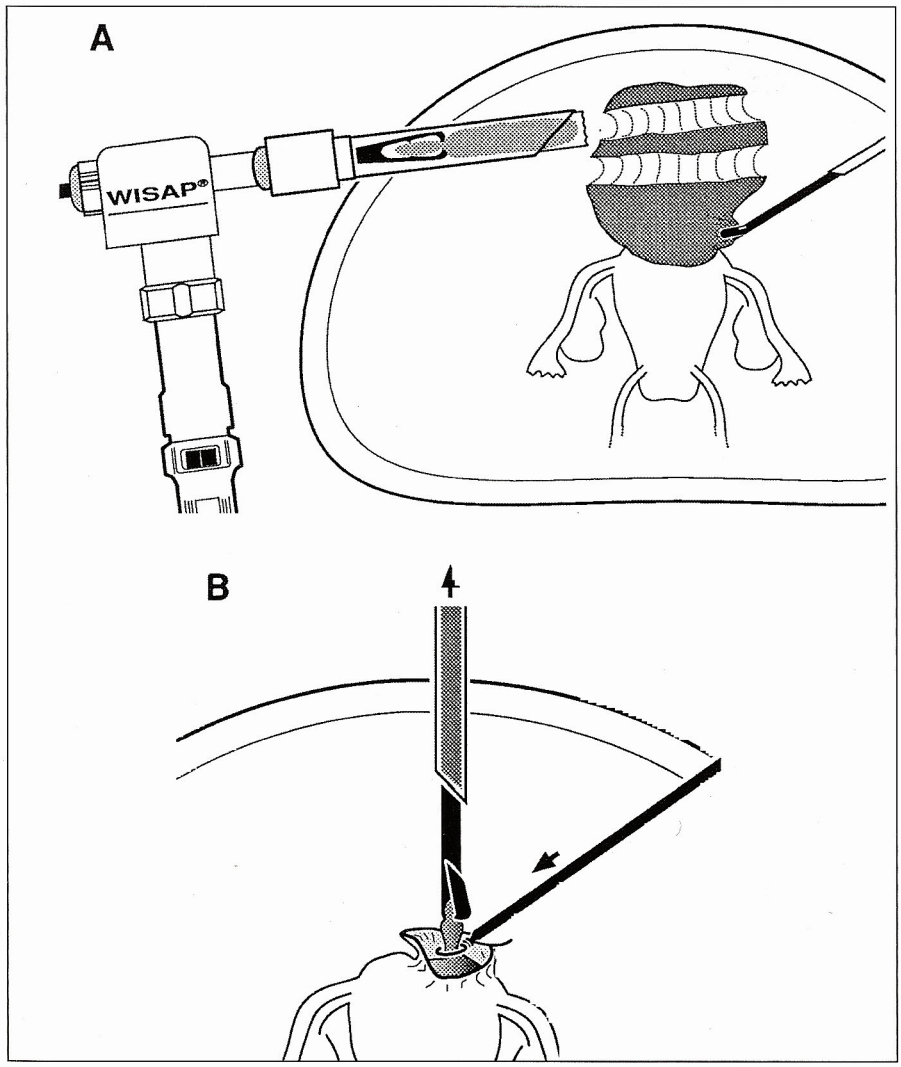

Figure 9. Morcellation of a myoma in situ using the WISAP Moto-Drive. (a) Morcellation, (b) final steps involving ligation of the myoma pedicle and intracorporeal suture of the capsule.

Edged Macro-Morcellator) with a battery operated motor in 10-, 15-, 20-mm-diameter is the optimal instrument for laparoscopic morcellation. The new and safe horizontal technique of introduction broadens the operative spectrum of both uterus-conserving and total procedures. STI

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