

## EDITORIAL

## The outburst age: How TEM ignited the MIS revolution

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Once questioned on what best surgery was, Sir Alan Parks, the great British surgeon elected President of the Royal College of Surgeons in 1980 and in those years working at St. Mark's Hospital in London, answered: "Surgery is good exposure, good exposure, good exposure". A few years later, Gerhard Buess began broadening Parks' concept by thinking of best surgery as a combination of two factors: Good exposure with minimally invasive access (Figure 1).

With this concept in mind and driven by his interest in applying technology to surgery, Buess started, with his colleagues Theis, Hutterer and Narhun, to develop a new approach to the surgical treatment of rectal neoplasms by transanal endoscopic microsurgery (TEM).

The rationale behind this work can be summarized by two clear needs:

- (1) For the treatment of large rectal adenomas: Reducing the complication rate of local rectal resections through the transacral approach (Kraske procedure) and the transphincteric approach (Mason procedure), at the same time avoiding the high recurrence rate of the Parks transanal approach;
- (2) for the treatment of early rectal cancers: Reducing the incidence of radical (Miles) procedures resulting in permanent colostomy (at that time the concept of sphincter-preserving radical

surgery for low rectal cancer was not yet as widespread as it is at the present time).

In 1983 and in the following years Buess reported the first results of this new technique (1–3). It was not only a visionary approach to rectal surgery, it was a tremendous effort in the field of engineering, made possible by the close collaboration with Richard Wolf Company, including the development of the newly designed operation rectoscope, the whole instrument set, the dissection tools (the high-frequency electrocautery knife), the stereo-endoscope, yet with a quality of vision still not matched by high definition camera systems, the CO<sub>2</sub> insufflation equipment featuring a roller pump for suction and insufflation to overcome the *soffietto* effect of a gas pumped in or evacuated from the small rectal cavity. The system allows moving and exchanging all surgical instruments and may be easily repositioned to achieve an optimal view of the lesion. Not to mention the development of the new modality of safely securing the running suture by silver clips, thereby replacing conventional suturing techniques and avoiding arduous intracorporeal knot-tying.

It is hard to say whether Gerhard Buess was aware of the technologies and the technique he developed being already the breakthrough not only in the field of colorectal surgery but in surgery as a whole: As a matter of fact, TEM can be considered the first ever natural orifice endoscopic procedure successfully



Figure 1. Surgeons pioneering modern colorectal surgery: (A) Sir Alan Parks, (B) Gerhard F. Buess, (C) RJ (Bill) Heald.

67 introduced into clinical practice. Among the pioneers  
68 of minimally invasive surgery, those small groups of  
69 surgeons who made minimally invasive surgery blast -  
70 from 1985 on - in almost all fields, encompassing  
71 thoracic surgery (Wittmoser, first operative thoraco-  
72 scopy and single port surgery), gynaecology (Semm,  
73 first laparoscopic appendectomy and annexectomy),  
74 general surgery (Müuhe and Mouret, first laparo-  
75 scopic cholecystectomy), Buess and his team were  
76 playing a very significant role with the development  
77 of single port natural orifice TEM, single incision  
78 endoscopic mediastinal dissection of the esophagus  
79 (EMDE), single port transumbilical cholecystectomy  
80 (4) and the first ever robotic assisted endoscopic  
81 surgical system (ISIS), the precursor of da Vinci  
82 (Intuitive Surgical, Sunnyvale, CA, USA) (5). In  
83 this ten-year time period, the outburst age of endo-  
84 scopic procedures that ignited the minimally invasive  
85 surgery revolution, he greatly contributed to the  
86 diffusion of this new philosophy in patient care, by  
87 training hundreds of surgeons from all over the world.

88 What Buess certainly could not know was that after  
89 two decades TEM would have been considered also  
90 as both the first ever natural orifice transluminal  
91 endoscopic surgery (NOTES) and the first ever single  
92 access endoscopic procedure. As a matter of fact,  
93 these new approaches, the ultimate edge of minimally  
94 invasive surgery (MIS), the development and diffu-  
95 sion of which started at the beginning of the third  
96 millennium, subsume the concept of performing sur-  
97 gery without resulting scars and performing surgery  
98 through a single multiport device, a concept that  
99 comes from the original idea of TEM (6,7). In the  
100 last years of his life, Buess himself approached the  
101 new-born, or reinvented, concept of natural orifice  
102 trans-luminal surgery by avoiding the problems of  
103 doing surgery through flexible endoscopes: He further  
104 modified the technology of the TEM rigid scope and  
105 optic in order to use them for entering the peritoneal  
106 cavity through the trans-vaginal route (8).

107 With the constant improvement of the TEM  
108 technologies and technique over the years, the indi-  
109 cations of such a procedure have also broadened (9).

Among the new technology advancements one  
should mention:

- The newly designed rigid teaching system inte-  
grated into the stereoscopic optic;
- the new pneumatically controlled quasi-bipolar  
combination instrument, featuring dissection,  
coagulation, rinsing and suction options developed  
by Erbe Company (Tuebingen, Germany (10));
- the new design of a wider access port in the  
operation rectoscope to decrease instrument  
hampering and enhance freedom of movements.

At the same time, other operation rectoscopes  
became commercially available and new dissection  
technologies such as ultrasonic dissection or suturing  
techniques were introduced to decrease oozing and  
accelerate the procedure (11).

TEM was conceived to be the optimal surgical  
treatment for large benign lesions of mid and lower  
rectum, but has increasingly been used to treat other  
rectal diseases, from stricture to prolapse, from retro-  
rectal masses removal to management of early rectal  
cancer with curative intent or advanced cancer for  
palliation. The opening of the peritoneum during the  
course of the procedure was no longer seen as a  
complication but accepted as routine part of the  
radical dissection of upper rectal lesions, with no  
increase in postoperative morbidity. Small series  
have been reported showing results of TEM in com-  
bination with neo-adjuvant chemo-radiation therapy  
(CRT) for locally advanced rectal cancer (12). In the  
last 15 years the role of TEM for rectal cancer treat-  
ment started to be investigated, especially in Western  
countries: Preoperative assessment, long-term results,  
combination with neo-adjuvant CRT, watch-and-  
wait versus a more aggressive policy after TEM for  
undiagnosed or incidental cancer, imaging technolo-  
gies to be employed for postoperative follow-up being  
the most crucial and controversial issues. Local exci-  
sion versus radical surgery of rectal cancer is a major  
quest which deserves larger multicenter trials and  
further systematic reviews of results on a much larger  
scale (13).



Not surprisingly, a Pubmed search with the MeSH term “transanal endoscopic microsurgery”, restricting the search field by filtering for systematic reviews only, resulted in 68 reviews published since 1993, the year of publication of the first TEM review by Buess, witnessing the growing interest in this minimally invasive technique (14). Most of the recent reviews are dealing with the role TEM may play in the treatment of early rectal cancer (15–19). Nevertheless, indications, relevant potential and limitations of TEM yet remain unclear.

*TEM meets TME:* The early nineteen-eighties were pivotal years for surgeons and researchers working in the field of colorectal surgery, especially interested in the surgical treatment of rectal cancer. In 1982 and in the following years, almost the same years Buess was developing TEM, Bill Heald (Figure 1) published the first results of what would become the standard radical treatment of rectal cancer: Total mesorectal excision (TME) (20,21).

Preserving the integrity of the mesorectal fascia, carrying out a nerve sparing procedure by avoiding the damage of sympathetic and parasympathetic fibres in the deep pelvis is often challenging because of the narrow working space and the poor view. The transanal endoscopic approach to radical excision of the perirectal fat and its overlying fascia, which is an evolution of the trans-abdominal trans-anal (TATA) procedure with bottom-up dissection of the distal rectum (22), provides three theoretical advantages:

- A clear and magnified view of the cleavage plane (“the holy plane”),
- a straight dissection line up to the peritoneal reflection, especially along the anterior aspect of the rectum, and
- specimen extraction through a natural orifice, thus avoiding the need for a minilaparotomy.

Transanal endoscopic TME is performed either by the TEM operation rectoscope, as suggested by Buess (6), or via a single access endoscopic surgery (TAMIS) device, with similar efficacy and promising early results (23–25). This procedure is not only a combination of two endoscopic techniques (TEM and laparoscopy), it represents the ultimate match point of several MIS approaches, where the TEM principles merge with those of NOTES, single access laparoscopy and endoluminal surgery.

Above all, it is remarkable that TEM and TME, two independently developed procedures which in the last decades have had the greatest impact on rectal surgery, have been combined with the outcome of better results and improved quality of life for cancer patients.

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