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Original Research

Comparative evaluation of colonoscopy-assisted transanal minimally invasive surgery via glove port and endoscopic submucosal dissection for early rectal tumor

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HIGHLIGHTS

- CA-TAMIS-GP is a novel method to manage early rectal tumor, which is safe and effective and has potential for use as a substitute for TEM and ESD.

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ABSTRACT

Background: Early rectal tumor is usually managed by local excision. A novel method—colonoscopy-assisted transanal minimally invasive surgery via glove port (CA-TAMIS-GP)—for resecting early rectal tumor was developed and compared with endoscopic submucosal dissection (ESD).

Materials and Methods: We performed CA-TAMIS-GP surgery on 26 patients from January 2014 to February 2016. For better analysis, we retrospectively collected data from 31 patients who underwent ESD between October 2012 and December 2013; overall, 57 patients diagnosed with early rectal tumor were included in this study. Perioperative conditions and long-term outcomes of both groups were compared.

Results: All lesions were dissected completely and successfully without conversion to open surgery or major complications. On histopathologic examination, all specimens in this study had negative margins. All patients had uneventful postoperative recoveries, except 3 patients of CA-TAMIS-GP with minor hematochezia, which resolved spontaneously; 7 ESD patients had late-onset bleeding and 3 needed colonoscopic hemostasis; 2 patients in each group had mild fever. The CA-TAMIS-GP group had a shorter operation time, less hemorrhage, and a lower average consumable cost than the ESD group ($P < 0.05$); moreover, the CA-TAMIS-GP group had no recurrence or long-term complications during a follow-up of 10–32 months, whereas3 patients in the ESD group developed local recurrence during a follow-up of 24–36 months.

Conclusions: The CA-TAMIS-GP is a new method that is safe and effective in patients with early rectal tumor and appears to have a shorter operation time and less blood loss as compared with ESD.

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1. Introduction

The third most common cancer worldwide, colorectal cancer has a reported incidence of 1.5 million cases, and 694,000 deaths in 2012 were attributed to this cancer [1]. The increasingly widespread application of colonoscopy screening is expected to significantly increase early detection of rectal cancer in the pTis and pT1 stages [2,3]. Early rectal tumor is usually managed by local excision to avoid morbid outcomes, such as urinary dysfunction, sexual dysfunction, and the use of permanent colostomy. However, there is no consensus on the standard treatment of early rectal tumor, and surgical resection techniques used most often for local excisions include endoscopic mucosal resection (EMR), endoscopic submucosal dissection (ESD), transanal endoscopic microsurgery (TEM), transanal minimally invasive surgery (TAMIS), and so on [4–6].

Endoscopic mucosal resection and ESD are the 2 main endoscopic approaches for treating early rectal tumor. Originating in

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Japan [7], these techniques were the adopted in China [8,9], and have gained widespread acceptance not only in Asia but also in Western countries [10]. EMR is only applicable in lesions smaller than 20 mm, whereas ESD is suitable for larger laterally spreading tumors (LSTs), with a higher *en bloc* rate and lower recurrence rate. However, challenges in the clinical application of ESD include longer procedural duration and a higher incidence of complications [11].

Despite the wide spread acceptance and application it has because of the promising outcomes it provides, the high cost and steep learning curve associated with TEM are not insignificant [12]. TAMIS—a novel surgical approach—was developed more recently and applied in the treatment of early-stage rectal cancer. TAMIS involves the use of a multichannel port transanally [13] in combination with standard laparoscopic instruments, camera lens, and a CO_2 insufflator to conduct endo- or extra-luminal surgery. Currently available platforms for TAMIS include the GelPOINT Path (Applied Medical), SSLPort (Ethicon), and SILSPort (Covidien). However, these commercial transanal ports are expensive although they are user-friendly. The transanal glove port approach—using a glove to build an enclosed transanal platform, with laparoscopic pneumoperitoneum devices and screen output as an alternative to TEM procedures—provides a feasible substitute for these existing commercial transanal ports [14,15]. In the clinical setting, colonoscopy is equally effective as laparoscopy, as an alternative adjunct to TAMIS, with regard to display, lighting, suction, and air insufflation features. Moreover, it is technically simple, practically applicable, and cost-effective. This has broadened the scope of application for colonoscopy, which is used not only in EMR and ESD, but also in TAMIS.

Over years of clinical practice, we developed a novel method to manage early rectal tumor—colonoscopy-assisted transanal minimally invasive surgery via glove port (CA-TAMIS-GP). This study was designed to comparatively evaluate the safety and efficacy of surgical resection with CA-TAMIS-GP and ESD in early rectal tumor.

2. Material and method

2.1. Patients

We performed CA-TAMIS-GP surgery on 26 patients from January 2014 to February 2016. To have a better contract, we retrospectively collected data from 31 patients underwent ESD between October 2012 and December 2013. A total of 57 patients diagnosed with early rectal tumor were included in this study. From October 2012 to February 2016, 57 patients were diagnosed with early rectal tumor according to the Paris classification of superficial neoplastic lesions, in the Endoscopy Division, Hangzhou Number Three People's Hospital, Hangzhou, Zhejiang province, People's Republic of China. Of these, 26 patients underwent CA-TAMIS-GP from January 2014 to February 2016 and the other 31 patients were treated with ESD between October 2012 and December 2013. Clinicopathological data including age, sex, tumor location, tumor diameter, operation time, postoperative histological results, postoperative complications, and follow-up data were collected. All subjects provided written informed consent for study participation. This study was approved by the institutional review board.

2.2. Inclusion and exclusion criteria

Inclusion criteria were: (1) newly diagnosed early rectal tumor confirmed by colonoscopy and histopathology of biopsy specimen; (2) tumor diameter of 40 mm or less; (3) no history of other malignancy or co-occurrence with another cancer. Exclusion criteria were: (1) histopathologic evidence of submucosal involvement; (2) coagulopathy; (3) comorbidity, such as unstable angina pectoris, cardiac failure, pulmonary infection, etc.

2.3. Preoperative management

All subjects were preoperatively admitted to the Colorectal Surgical Ward and assessed through complete blood count (CBC), comprehensive metabolic panel (CMP), coagulative function, cardiopulmonary function, and so on to exclude patients ineligible for surgery. Magnetic resonance imaging (MRI) of the pelvis and intraluminal ultrasonography were applied to evaluate neoplastic infiltration and to exclude patients with submucosal cancer infiltration. Mechanical bowel preparation with polyethylene glycol lavage was routinely undertaken, and antibiotic prophylaxis for infections was administered 30 min preoperatively and 24 h postoperatively.

2.4. Operative procedures

2.4.1. CA-TAMIS-GP surgeries

All patients (n = 26) were administered continuous epidural or lumbar anesthesia in the lithotomy or lateral position. All surgical procedures were undertaken by senior colorectal surgeons and assistants with expertise in endoscopic operations. First, a transanal glove port was established by the colorectal surgeon. Following anal retraction with a disposable anal retractor, a powder-free surgical glove (ENDOPATH Dextrus HAPO2, #6) was inserted into the anus and the circular anoscope device (CAD; Panther Healthcare, Beijing, China) was secured. Then, the cuff of the glove was pushed approximately 2–3 cm into the anorectal ring, folded at the proximal opening of the anoscope, and sealed securely with a rubber band to make it airtight (Fig. 1). The glove's cuff was then fixed with the CAD on the anus, with 5 fingers of the glove positioned external to the anus through the transparent anoscope to build a closed transanal surgical platform (Fig. 2).

The ultrasound knife (Harmonic ACE) or Ligasure knife (Covidien), a grasping forceps (KARL STORZ), and a colonoscope (Fujitsu, Japan) were inserted through 3 different finger ports of the glove and made airtight with rubber bands (Fig. 3). The colonoscope was then connected to the main endoscopy unit and electronic air and water suction devices and the glove port's integrity was tested by air insufflation. A transanal glove port can provide an enclosed surgical space when supported by the CAD.

All endoscopic procedures were undertaken by a single endoscopy specialist. The video capture system of the endoscope was used as the light source and for directing the endoscope, the air inflation device was used to inflate the surgical cavity and to expose the surgical field, and endoscope suction was used for clearing smoke and fluid from the surgical field. All laparoscopic procedures were undertaken by a surgeon with a colonoscopy assistant and using laparoscopic instruments, such as ultrasonic knife and clamp, for clamping, pulling, dissection, electrocoagulation, suturing, and so on (Fig. 4). After complete tumor excision, the specimen was sent for histopathology.

2.4.2. ESD procedure

The other group (n = 31) underwent standardized ESD. Following marking and submucosal injection, a circumferential incision was started from the initial surface mucosal and extended along the marked dots. This was followed by gradual dissection of submucosal reticular tissue under the lesion using the transparent cap as the step for stripping. Submucosal injection was carried out as needed throughout the dissection, and the wound was closed with metal clips.

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