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New direction for surgery: Super minimally invasive surgery

super minimally invasive surgery

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Abstract

Abstract: The main goal of modern medicine is to treat disease without destroying organ structures and to improve the health of patients. Minimally invasive surgery (MIS) is the most frequently performed type of surgery. However, both traditional surgery and MIS are likely to change the anatomical structures of the body, thus warranting subsequent reconstruction of the directly or indirectly affected structures and therefore decreasing quality of life (QoL) postoperatively. Thus, we propose a new treatment mode, super minimally invasive surgery (SMIS), which is defined as "curing a disease or lesion which used to be treated with MIS while preserving the integrity of the organs for the treatment of lesions which should be treated by surgery". In this study, we describe the origin, definition, operative channels, advantages and future prospects of SMIS.

Key Words: super minimally invasive surgery, minimally invasive surgery, treatment mode

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Core Tip: The main goal of modern medicine is to treat diseases without destroying organ structures and to improve the health of patients. Minimally invasive surgery (MIS) is the most commonly performed type of surgery, but it still has some of the same disadvantages as traditional surgery, including changes in anatomical structures that warrant reconstruction of internal organs or different organs. In this study, we describe a new treatment mode, super minimally invasive surgery (SMIS), which is defined as "curing the disease while preserving the integrity of the organs".

INTRODUCTION

Due to the development of new equipment and experts gaining valuable experience, surgery has become less invasive. Minimally invasive surgery (MIS) has been the most frequently performed type of surgery for several years, but regardless of the means by which MIS was developed, the treatment mode is still ultimately the same. Classic surgical operations are based on organ resection. Resection destroys the anatomical structures of the body to some degree. Reconstruction of internal organs or different organs is common after traditional surgery and MIS. Reconstruction changes the natural functions of the body, which might lead to dysfunction of the organ(s) or discomfort. Even if the disease has been cured, quality of life (QoL) has diminished. Such treatment methods may be required for advanced cancers, but they can be too radical for early cancers or benign lesions.

The human body continues to evolve to adapt to its environment. The physiological and anatomical structure should be suited to the modern environment. Each organ of the human body plays its own unique role in its interaction with other organs. The operating mechanism of the body is complex, and we still know little about this process. Scientists have failed to comprehensively explain the mysteries of the human body, and even the functions of individual organs have not been fully explained. Even the appendix, which was once regarded as useless, is now known to regulate immune functions. The aim of treatments such as biomaterial implantation and organ transplantation are to restore the original structure of the human body as much as possible and its natural condition. The

main goal of modern medicine (or treatment modes) is to treat the disease without destroying the organ structure and to improve the health of patients.

Therefore, a new treatment mode, named "super minimally invasive surgery (SMIS)", was first proposed by Linghu in 2016.[1, 2] This new mode is defined as "curing the diseases that require sugery while preserving the integrity of the organs for the treatment of lesions which should be treated by surgery". Organ resection is inevitable during MIS and traditional surgery. Organ resection and reconstruction are not involved in SMIS, so the SMIS is even less invasive, which therefore improves patient QoL.[3, 4] SMIS includes not only endoscopic surgery but also some surgical operations. Therapies for diseases advance over time, and there are always more operative methods expected to become available.

SMIS is mainly operated through four operative channels. The first channel of SMIS is performed through the natural lumen and is called natural orifice translumenal endoscopic surgery (NOTES). The following are examples of SMISs that are performed in a similar manner as NOTES: endoscopic submucosal dissection (ESD), endoscopic mucosal resection (EMR), endoscopic submucosal excavation (ESE), and endoscopic full-thickness resection (EFR)[5]. The second channel is performed through the submucosal tunnel. A tunnel is made between the mucosal and muscularis propria layers. This kind of SMIS is also called the digestive endoscopic tunnel technique (DETT) and is used in used in treatment of gastrointestinal lesions.[6] The following methods are traditional examples of SMIS that is performed using the DETT: endoscopic submucosal tunnel dissection (ESTD), submucosal tunnel endoscopic resection (STER), and peroral endoscopic myotomy (POEM). The third type is performed through the transmural channel and is called video-assisted thoracoscopic enucleation (VATE), which involves only removing lesions through the skin or cholangioscopy-assisted extraction of choledocholithiasis without endoscopic sphincterotomy.[7, 8] The last type is performed via multiple cavity channels. This type of SMIS represents a combination of different treatment methods, such as laparoscopy- or thoracoscopy-assisted endoscopic surgery.

Taking digestive diseases as an example. SMIS can be mainly divided into two types, namely resection and drainage. Most benign lesions and some malignant lesions can be resected; however, drainage is mainly applicable for benign lesions. Benign lesions, such as gastrointestinal stromal tumors (GISTs), lipomas, leiomyomas, and polyps, can be resected via SMIS, and malignant lesions, such as early gastrointestinal tumors and neuroendocrine tumors (NETs), can also be resected via SMIS without disrupting the integrity of their affected organs. Drainage is mainly used to treat pancreatic pseudocysts (PPCs), pancreatic walled-off necrosis (WON), gallbladder stones, biliary tract stones, suppurative cholangitis, and suppurative appendicitis. SMIS is restricted by surgical instruments and operator experience. Not all benign lesions can be treated by SMIS. Large lesions and lesions with a rich blood supply are not indicated for SMIS. In addition, SMIS is not indicated for all malignant tumors in their early stage. For example, surgical resection is suggested for early gastric tumors with lymph node metastasis. Partial gastrectomy and lymphadenectomy can be performed during laparoscopy or open surgery. However, SMIS is not suitable to successfully treat this kind of cancer. Because SMIS can be performed via multiple cavity channels, it is expected to be useful for treating this kind of cancer; moreover, endoscopic resection of cancer combined with laparoscopic dissection of lymph nodes is recommended for the treatment of this kind of early cancer.[9] We believe that more benign diseases will be indicated for SMIS. With an increasing number of malignant lesions being detected in the early stage, more malignant lesions can also be treated by SMIS.

The differences between SMIS and MIS/traditional surgery can lead to distinct differences in prognoses. Early cancer located on the gastric cardia or near the gastric cardia is an example of a malignant lesion that is suitable for endoscopic submucosal dissection (ESD) or endoscopic submucosal tunneling dissection (ESTD), as both methods do not damage the cardiac structures (Video 1A). In both MIS and traditional surgery, malignant lesions can be resected as well as the cardia and even all or part of the stomach and some of the esophagus. The esophagus and stomach are connected, so reconstructing artificial gastroesophageal junctions is reasonable (Video 1B).

Gastroesophageal anastomosis does not involve the low esophageal sphincter (LES) and thus induces an antireflux effect. Losing the cardia causes abnormal gastrointestinal dynamics and reflux. These patients must sit in bed to avoid experiencing symptoms of heartburn. Compared to the postoperative conditions of patients who undergo MIS and traditional surgery, those of patients who undergo SMIS is good in that they are free of cardiac cancer. SMIS, such as submucosal tunneling endoscopic resection (STER) or endoscopic submucosal excavation (ESE), is suitable for effectively resecting a benign rectal gastrointestinal stromal tumor (GIST) originating from the muscularis propria layer while preserving the integrity of the rectum and anus. The QoL of patients was not affected after SMIS. Traditional surgery involves resection of not only the GIST but also the rectum and anus, leading to residual large intestinal stumps attached to the abdomen. After enterostomy, the patients' defecation rhythms could not be controlled because of the lack of an anus. Abdominal fistula bags prevented patients from engaging in normal life and work activities.

CONCLUSION

We expect SMIS to be widely performed in the near future. We hope it can point to the new direction of surgery. It is applicable to more than digestive diseases. We believe that more and more diseases can be treated without changing any anatomic structure. SMIS could be regarded as a goal for the treatment of diseases involving many systems.