

Original Article

Retrospective study of initiative content reduction on prevention of postoperative intra-abdominal hypertension in herniorrhaphy of obese patients with giant ventral hernia

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Abstract: Objective: The aim of this study was to evaluate the efficacy of initiative content reduction in preventing postoperative intra-abdominal hypertension (IAH) in herniorrhaphy of obese patients with giant ventral hernia. Methods: Clinical data of 85 obese patients with giant ventral hernia that underwent herniorrhaphy with initiative content reduction, from January 2013 to December 2016, in Beijing Chao-Yang Hospital, Capital Medical University, were collected and retrospectively analyzed. All patients were followed up routinely to observe postoperative recovery (improvement of intra-abdominal pressure (IAP) and intravesical pressure (IVP)), any surgery-related conditions, and postoperative complications. Results: IAP and IVP were both significantly improved after treatment (both $P < 0.05$). Average operation time was 115.8 ± 22.6 minutes, length of bowel resection was 206.8 ± 64.9 cm, average blood loss during the operation was 67.8 ± 26.4 mL, and average length of hospital stay was 14.7 ± 2.1 days. Postoperative incision site infections occurred in 4 patients with recurrence in 3 patients. All recovered after relevant measures were taken. Conclusion: Initiative content reduction techniques can effectively prevent postoperative IAH aiming at giant ventral hernias of obese patients.

Keywords: Obesity, giant ventral hernia, intra-abdominal hypertension, initiative content reduction

Introduction

Ventral hernia is a common disease of the abdominal wall caused by various congenital and acquired factors. Recent reports have shown an increasing trend in ventral hernias due to abdominal surgery [1, 2]. If ventral hernia is not treated in a timely manner, it can progress to giant ventral hernia, seriously affecting patient quality of life [3, 4]. Obesity progressively weakens the abdominal wall, leading to ventral hernia and surgical difficulties [5, 6].

Herniorrhaphy is currently the only way to treat giant ventral hernia [4]. However, returning a large content of hernia into the abdominal cavity may increase intra-abdominal pressure (IAP), resulting in multiple organ dysfunction and furthering abdominal compartment syndrome (ACS). These severely affect the prognosis of patients and can be fatal if not treated promptly [7-9]. ACS-related mortal-

ity reported abroad has been as high as 60% [10, 11]. Abdominal decompression and temporary abdominal closure techniques are currently the most important means of clinical prevention of ACS. This present study retrospectively analyzed clinical data of 85 obese patients with giant ventral hernia that underwent herniorrhaphy with initiative content reduction, from January 2013 to December 2016, in Beijing Chao-Yang Hospital, Capital Medical University. This study also observed the clinical efficacy of this technique regarding prevention and treatment of intra-abdominal hypertension (IAH).

Materials and methods

Case selection

Clinical data of 85 obese patients with giant abdominal hernia who were admitted to Beijing Chao-Yang Hospital, Capital Medical University from January 2013 to December 2016 were retrospectively analyzed. All patients were in

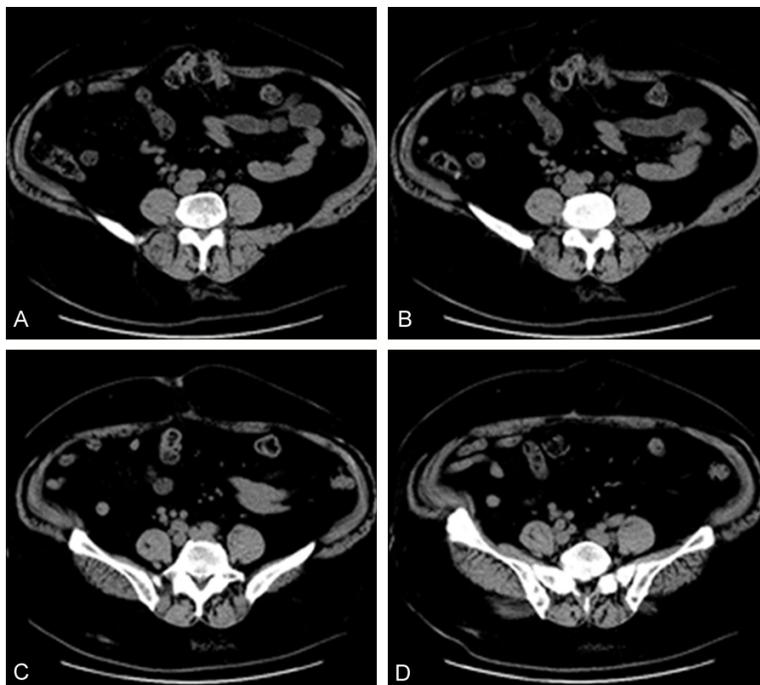


Figure 1. CT image Image of a 56-year old Russian male with a 30-year history of hypertension and highest recorded blood pressure of 210/120 mmHg. The patient had a history of diabetes and coronary heart disease for more than 10 years and had hepatitis C infection for the last 5 years. His blood pressure was in control; he had normal liver function and was receiving oral Adalat and aspirin treatment. Laparoscopic left renal cystectomy was performed 3 years ago. The diameter of the patient's hernial ring was 25 cm and volume of the abdominal wall mass was 20 cm * 30 cm. CT examination showed that the lower edge of the hernia ring was close to the pubic symphysis and bladder. A, B: Umbilical hernia, visible intestine and omentum shadow through the umbilical defect, local intestinal dilatation and free ascites in abdominal cavity, and obvious fat infiltration of rectus abdominis. C, D: Left semilunar hernia and expanded intestinal canal.

compliance with the relevant provisions of the 2012 Guidelines for the diagnosis and treatment of incisional hernias in the abdominal wall. (1) presence of abdominal mass, medium and hyperechoic tumors in the middle line of upper abdomen and local defects of the abdominal wall in ultrasonography; (2) enlarged hernia sac with surface peritoneum; and significantly higher IAP [6].

Of the 85 patients, there were 36 males and 49 females, aged between 53-80 years old, with an average age of 63.8 ± 5.6 years. Diameter of the herniation ring was between 12-25 cm and the average body mass index (BMI) of patients was 30.4 ± 2.7 kg/m². Specific volume of hernial content was calculated by multilayer length and width comparison of MRI and CT scans. There were 25 cases complicated with type 2 diabetes mellitus, 22 with hypertension,

16 with cerebrovascular disease, 15 with emphysema and chronic bronchitis, and 13 with coronary heart disease.

This study was approved by the Ethics Committee of Beijing Chao-Yang Hospital, Capital Medical University, and all patients signed informed consent.

Inclusion and exclusion criteria

Inclusion criteria: 1) pre-surgery CT examination showing hernial ring diameter greater than 12 cm; 2) single incisional hernia; 3) patients performed with initiative content reduction, removing part of the small intestine and mesenteric adhesions; 4) pre-operative IAP was above 20 cmH₂O and BMI above 28 kg/m²; 5) no diseases of the liver, kidneys, heart, and other vital organs; and 6) availability of all data including gender, age, IAP, BMI, imaging data, and medical history as well as compliance with treatment and follow up.

Exclusion criteria: 1) patients with multiple abdominal hernias and multiple herniorrhaphies; 2) inability to tolerate general anesthesia; 3) incomplete clinical data; and 4) patients lost during follow up.

Data extraction methods

Data of patients were collected by reading electronic and paper medical records. When collecting data, researchers payed attention to quantification of data and objective production of statistical tables. Before sorting and analyzing data, the integrity and accuracy of information was checked. Statistical analysis followed.

Observation indices

Primary observation indices: 1) operation-related conditions like operation time, length of bowel resection, intraoperative blood loss, and

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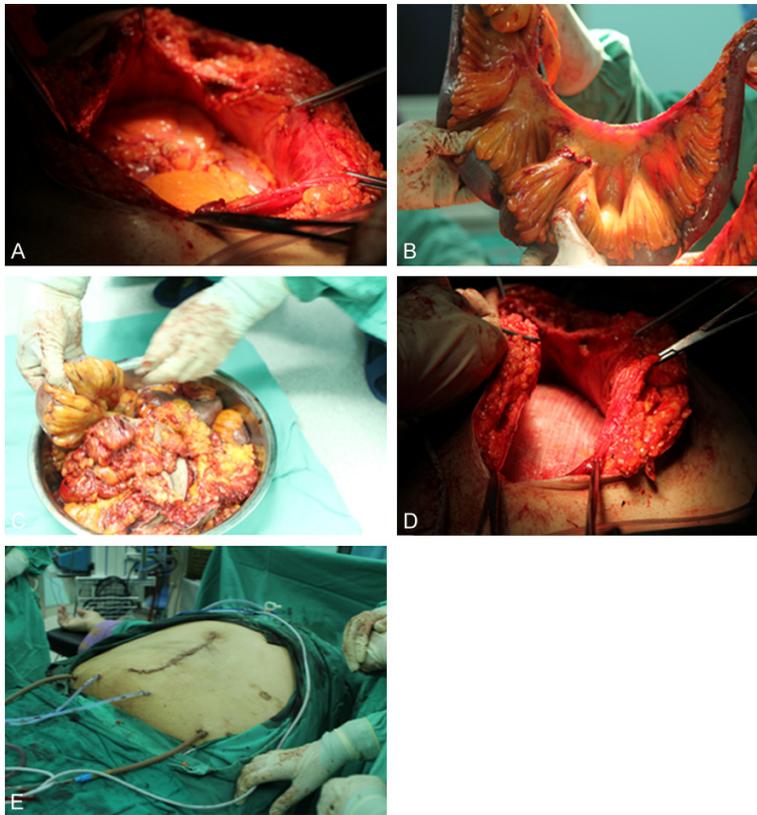


Figure 2. Operation procedures (A) The peritoneum was cut open and the size of the abdominal wall defect of the patient was found to be approximately 20 cm * 20 cm; (B) Total bowel length was approximately 10 m; (C) A total of 4.5 m length of small intestine and the mesentery was removed; (D) The edge of the defect was measured, tissues were separated and a 20 cm * 30 cm Tatalman patch was placed 5 m from the margin; (E) An absorbable wire was used to close the hernial ring defect and the patient's abdominal cavity, and 2 abdominal and subcutaneous drainage tubes were inserted. Due to old age and poor surgical tolerance, the patient experienced symptoms such as unstable blood pressure, low blood saturation, and dizziness during surgery, but recovered after emergency treatment.



Figure 3. Photograph of patient one week after the operation. The patient recovered well and the operation was effective.

length of hospital stay; and 2) IAP and intravesical pressure (IVP) before and after surgery.

Secondary observation indices: initiative content reduction surgery complications (intra-abdominal infection and intestinal fistula) and general complications (abnormal renal and respiratory functions and incision site infections).

Statistical analysis

Both electronic and paper medical records of patients were studied. Collected information was converted into measurable data and an original database was established along with objective statistical tables. After verifying the integrity and accuracy of the data, they were statistically analyzed using SPSS 22.0 program. Counting data are represented by n or percentage and were compared using Chi-squared test. Measurement data are expressed by mean \pm standard deviation ($\bar{x} \pm sd$) and were compared by t-test. $P < 0.05$ was considered statistically significant.

Results

Summary of treatment methods

All patients started preoperative preparation one day before surgery and consumed only liquid foods. The intestinal tract was cleaned 12 hours before the operation with polyethylene glycol. See **Figure 1**. Patients were given general anesthesia and the position of the hernia sac was selected as the site of fusiform incision. Scar skin was removed and the hernia sac was separated starting from the adhesions of the operative area, then excised. The abdominal cavity was cleaned and checked for any lesions. A portion of the small intestine and mesentery (about 120-380 cm long) was removed based on preoperative CT examination and content examination. A linear incision closure device was used for side-to-side anastomosis and the ileocecal part of small intestine was preserved for pathological examination. After successful resection of the hernia, a

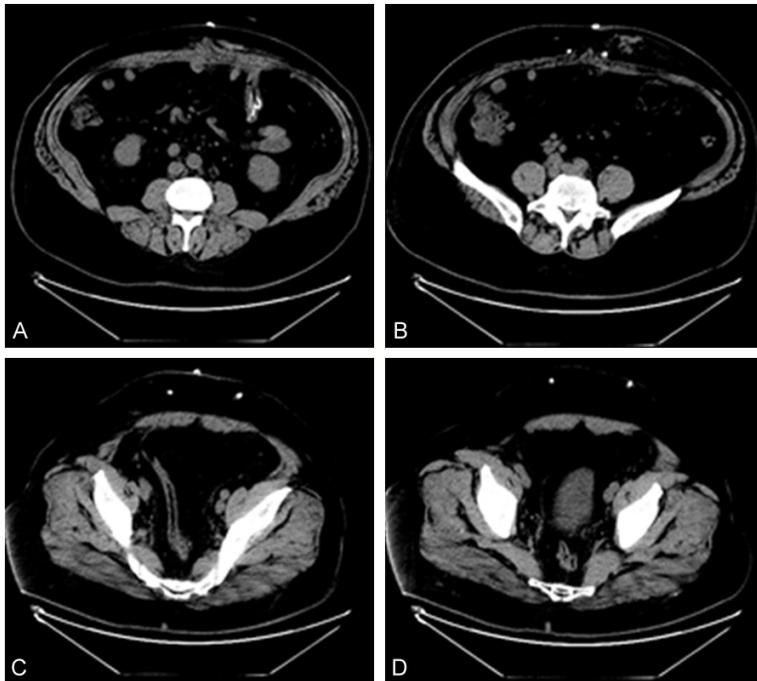


Figure 4. CT image of patient one week after surgery. (A) No significant infiltration of rectus abdominis fat; (B) No obvious dilatation and free ascites in abdominal cavity; (C, D) Above and below the midpoint of the connecting line between umbilicus and pubic symphysis, the bottom of the aponeurosis of the external oblique abdominal muscle and the front of the transverse fascia of the abdomen, abdominal cavity with no fluid and no thick-walled tubular shadow.

20 cm * 30 cm Tatelman patch was placed 5 cm from the margin. The hernial ring defect was closed with an absorbable wire. Drainage tubes were placed in the abdomen and subcutaneous area to prevent effusion as shown in **Figure 2**.

Surgical outcomes

All 85 patients underwent successful surgery. Average operation time, length of bowel resection, intraoperative blood loss, and length of hospital stay were 115.8 ± 22.6 minutes, 206.8 ± 64.9 cm, 67.8 ± 26.4 mL (35-210 mL), and 14.7 ± 2.1 days, respectively. All patients were followed up satisfactorily with an average follow up time of 33.4 ± 18.3 months. Photographs of postoperative recovery and CT images are shown in **Figures 3, 4**.

Changes in IAP and IVP before and after surgery

Compared with pre-surgery status, IAP and IVP were significantly improved at 1 week and 15 days postoperatively (all $P < 0.05$) as shown in **Table 1**.

Postoperative complications

None of the patients had any intestinal fistulas or intraabdominal infections. In addition, abnormal renal and respiratory functions were not encountered. Postoperative incision site infections occurred in 4 patients with an incidence of 4.70%. All patients improved after relevant measures were taken. Three patients relapsed at the 10th, 13rd, 23rd month after surgery (recurrence rate of 3.53%), as initiative content reduction surgery was performed again.

Discussion

With an increase in the number of patients undergoing abdominal surgery in recent years, incidence of postoperative incision hernia and parastomal hernia have also increased. Factors such as peritoneal effusion and obesity are more likely to lead to poor prognosis and even cause giant ventral hernia [12, 13]. It is critical to properly treat the content of hernia and ring during the removal of giant ventral hernia to reconstruct the abdominal wall. IAH is a common complication after removal of the huge hernia sac and returning contents into the abdominal cavity. ACS can also occur, seriously affecting prognosis and quality of life [14-16]. Therefore, improving abdominal wall compliance in patients is the key to improving IAH and promoting patient rehabilitation.

One study demonstrated good efficacy of preoperative progressive pneumoperitoneum for patients with giant ventral hernia [17]. This method aids in the assimilation of herniation contents in abdominal cavity and facilitates repair of abdominal wall hernia. It can also be used in patients with abdominal wall dysfunction to reduce incidence of ACS and IAH after herniorrhaphy [18].

Initiative content reduction surgery refers to the initiative removal of non-necrotic intestines, mesentery, and omentum during hernior-

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Table 1. Postoperative recovery of patients ($\bar{x} \pm sd$)

	Case	One day before surgery	One week after surgery	Fifteen days after surgery
IAP (cmH ₂ O)	85	15.6 ± 1.4	10.9 ± 2.2*	7.6 ± 1.9*
IVP (cmH ₂ O)		18.4 ± 1.8	12.5 ± 1.6*	8.7 ± 1.5*

Note: IAP, intra-abdominal pressure; IVP, intravesical pressure. Compared with one day before surgery, *P<0.05.

rhaphy in patients with abdominal hernia to avoid excessive IAP and ACS [19]. Kohler et al. showed that even experienced surgeons encounter IAH after treating patients with giant ventral hernias [20]. In this situation, the only option is to remove part of the abdominal cavity contents of patients. In this study, IAP and IVP of patients were significantly improved after resection of adherent intestinal and mesenteric tissues. Patients were given a series of anti-inflammatory and fluid infusion measures to restore gastrointestinal function. For patients with severe abdominal wall defects, part of the adhesion intestinal canal and omentum-majus were removed, but did not affect normal physiological function and avoided IAH [21]. In this present study, all 85 patients completed the operation successfully. Average length of the resected intestinal tract was 206.8 ± 64.9 cm. All patients were followed up satisfactorily after the operation. Postoperative incision site infections occurred in 4 patients (4.70%) with recurrence in 3 patients. After receiving antimicrobials and a second operation, conditions were controlled.

This study, by retrospective analysis, determined the value of initiative content reduction in treating giant ventral hernias in obese patients. This surgical method can effectively control IAH, improve IAP and IVP conditions, and reduce postoperative complications. It is, therefore, worthy of further clinical application. However, it is important to ascertain which organs and tissues can be removed to not only achieve content reduction but also avoid damage to the body. In addition, the present findings need to be validated with larger sample sizes and evidence-based studies to provide more support for future clinical research.

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Disclosure of conflict of interest

None.

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