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OMENTAL PLUG TECHNIQUE IN THE TREATMENT OF A LARGE PERFORATED PEPTIC ULCER (EXPERIMENTAL AND APPLIED STUDY)

By
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The immediate definitive operations for perforated peptic ulcer is never entirely safe. The present study was conducted on 20 patients presented with large perforated peptic ulcer and 10 dogs where large hole in their stomach was done experimentally. The patients and dogs were treated by omental plug technique. Twelve patients presented with perforated duodenal ulcer and 8 with gastric ulcer. In the applied part , the overall morbidity rate was 20%. The plug in the patients of perforated duodenal ulcer disappeared on the 4th postoperative day in 7 out of 12 patients but in perforated gastric ulcer disappeared on the 5th day in 6 out of 8 patients, there was neither re-perforation nor leakage. After 24 months of follow up for 18 patients , 4 patients (22.2%) were cured , 9 patients (50%) responded well to medical treatment and 5 patients (27.8%) continued to complain of ulcer symptoms and needed definitive surgery. After 8 weeks in experimental part, by gross examination the omental plug merged with the serosal surface of the stomach and the gastric hole disappeared without discontinuity of the mucosa and by histologic examination , few bundles of smooth muscle fibres were seen within the site of omental plug in all dogs. We conclude that, the omental plug technique is simple, excellent and life saving procedure but it has limited value to patient in terms of definitive cure.

Key words: *peptic ulcer, omental plug, applied, experimental.*

INTRODUCTION

During the last 2 centuries, surgeons rocked their mind in search for ways to use greater omentum in different fields of surgery. Omentoplasty was first used in 1826 , when Jobert and Fambelle recommended to insert a strip of greater omentum between the raw edges of an intestinal wound, then in 1866, Durmonds and Morison thought of using greater omentum in the treatment of ascites[1].

By the mid of 19th century and thereafter, greater omentum has been used to drain lymphoedema, dry up suppuration, save leg or foot in traumatic bone disruption and soft tissue destruction or to treat perforated peptic ulcer[2].

In humans, the commonest perforation of the upper gastrointestinal tract is that of duodenal ulcer. The most widely used technique for dealing with perforated peptic ulcer is using a strip of the omentum drawn under an arch of full thickness sutures placed on either side of the perforation[3]. The omental patch technique is useful for small holes, it is associated with leakage when the perforation is large. This prompted a consideration of an alternative technique like omental plug for patching a large perforated peptic ulcer, which avoids the development of omental ischaemia and subsequent releakage[4].

Omental plug technique was used in this study to satisfy these requirements . The experimental work aimed in understanding the sequence of histological changes of greater omentum after being plugged into an artificial hole in the stomach of dogs, but the applied work aimed in

studying human complications, clinical and upper endoscopic outcomes.

PATIENTS AND METHODS

The present study included two parts, the first part was done on 20 patients and the second part was done on 10 dogs " experimental ".

The applied part included twenty patients (4 females and 16 males), aging between 15 and 87 years (the mean age was 53.2 years) who had perforated peptic ulcer and were admitted to Gastrointestinal Surgery and Endoscopy unit. Every patient was subjected to : full history taking, thorough clinical examination, relevant laboratory work up, erect lower chest and upper obdomen plain X-ray, and abdominal ultrasonography.

In immediate postoperative period, the time of removal of nasogastric tube was estimated by slight traction on the tube starting from the 3rd postoperative day and upper endoscopy without insufflation was performed at the 4th and 5th postoperative day to assess the omental plug in the stomach and duodenum. Postoperative follow up was achieved for 12-24 months for 18 patients (mean of 21 months) based on history taking, clinical examination, and oesophagogastroduodenoscopy at 2,4,6,12, and 24 months postoperatively.

Operative technique of applied part:

- Under general anaesthesia, with the patient supine, an upper midline incision was done. Sample of free fluid in the peritoneal cavity was aspirated, suction of the peritoneal spillage and complete exploration of the abdominal organs were done.
- The site of perforation was identified either duodenal or gastric and if it was gastric, biopsies were obtained from its edges for histopathological examination (ulcers less than 0.5 cm. in diameter were excluded from the study).
- The nasogastric tube was advanced by the anaesthetist and guided through the perforation by the surgeon.
- The tip of the pedicled omental flap was fixed to the tip of nasogastric tube with (o) chromic catgut sutures .
- The tube was drawn back and the omentum was subsequently plugged into the perforation resulting in its blocking.
- The edge of the omental plug was tacked to the margins of perforation using dixon sutures (2/0).
- Meticulous peritoneal toilet was performed and the abdominal cavity was drained with suction drains.

In the experimental part, 10 healthy dogs with an average weight of 13.2 kg. (range 11-16.5 kg.) were used for the study. The animals were housed in the animal house of Faculty of Medicine, Tanta University.

The dogs were anaesthetised using thiopental sodium 0.5 gm slowly I.V, operative procedures were carried out under clean, not sterile condition.

After upper midline laparotomy incision, a hole 4 cm wide was created in the anterior wall of the antrum of the stomach. A pedicled part of greater omentum was plugged into the hole with 2-3 cm intragastric bulge and the edges of the hole were sutured to the omental plug with 2/0 Dixon sutures taking care not to jeopardise any big vessel in the pedicle.

Postoperatively, the dogs had received I.V fluids and antibiotics (Ampicillin). Two dogs were sacrificed on 7th day, 4 dogs were sacrificed after 4 weeks and the last 4 dogs were sacrificed after 8 weeks.

Dogs were killed by a large dose of thiopental sodium given rapidly by I.V. route and their stomach and duodenum were examined grossly. Then specimens from the area of the previous omentoplasty were prepared for histological examination, after being stained with H/E .

RESULTS

The applied part of this study was carried out on twenty patients with perforated peptic ulcer. The main complaint in all patients was abdominal pain of sudden onset (Table 1). Twelve patients presented with perforated duodenal ulcer and eight patients with gastric ulcer and the size of the perforation was 0.5-1 cm in 8 patients (40%) and more than 1 cm in 12 patients (60%). The operative time ranged from 45-60 minutes (mean of 46.5 min).

Early postoperative complications rate was 20% including respiratory problems predominated and occurred in 3 patients (15%), two complicated by pleural effusion and the third by pneumonia, wound dehiscence occurred in one of the respiratory compromised patients (5%) and wound infection occurred in 2 patients despite the use of antibiotics according to culture and sensitivity. These complications were successfully treated by appropriate measures. There was neither leakage nor reperforation during the period of follow up. The nasogastric tube was removed on 3rd postoperative day in 13 patients (65%) and on the 4th day in 7 patients (35%).

Upper endoscopy revealed that the plug in the cases of perforated duodenal ulcer had disappeared on the 4th postoperative day in 7 out of 12 patients but in perforated gastric ulcer had disappeared on the 5th day in 6 out of 8 patients (Table 2 and Fig. 1,2) .

The long term follow up study included 18 patients as one patient died from non ulcer cause and the second one proved to have gastric adenocarcinoma and was subjected to total gastrectomy with simple Roux – en – Y reconstruction.

According to Visick grading and upper endoscopic examination at 2, 4, 6, 12 and 24 months postoperatively , 4 patients (22.2%) were cured, 9 patients (50%) responded well to medical treatment and 5 patients (27.8%) continued to complain of ulcer symptoms and needed definitive surgery (Fig. 3).

In the experimental work, no operative mortality, gastrointestinal bleeding or peritonitis was reported.

Macroscopic findings: After 7 days, the omental plug became adherent to the serosal surface of the stomach. The hole became about half of its original width, the intragastric part of the omental plug disappeared and looked like granulation tissue and the cut section showed integration of the omental pedicle into the gastric wall with discontinuity of the mucosa (Fig. 4). After 4 and 8 weeks, the omental plug merged with the serosal surface of the stomach in all animals. The gastric hole disappeared without discontinuity of the mucosa. The cut section showed no abnormality by the naked eye.

Microscopic findings: After 7 days, the omental plug was transformed into granulation tissue at its surface with gradual transformation into fibrous tissue towards its base (Fig. 5).

After 4 weeks, the omental plug was replaced by dense fibrous tissue and completely covered by normal gastric mucosa in 3 out of 4 dogs (Fig. 6).

After 8 weeks, the site of the plug was completely covered with normal mucosa and few bundles of smooth muscle fibres were seen within the site of omental plug in the 4 dogs (Fig. 7).

Table (1) *: The clinical manifestations in the studied cases.*

Clinical feature	*No. of cases*	*Percentage*
- Abdominal pain	20	100%
- Abdominal rigidity	20	100%
- Nausea and vomiting	16	80%
- fever	15	75%
- shock	11	55%
- Dehydration	9	45%
- Absent bowel sound	3	15%
- History of ingestion of NSIDs and / or corticosteroid	9	45%
- History of peptic ulcer treatment	4	20%

Table (2) : ***Time of disappearance of the omental plug in humans.***

Time after the operation	*Gastric ulcer*	*Duodenal ulcer*
4th day	2	7
5th day	6	5
Total	8	12

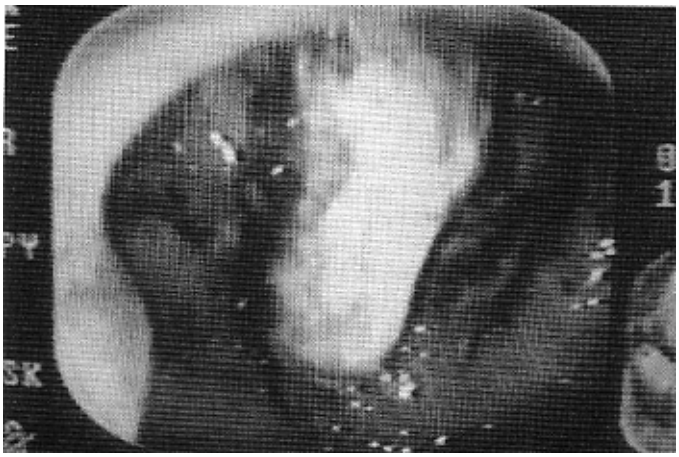

Fig.(1) : Endoscopic picture for a case of perforated gastric ulcer with omental plug still present 4 days postoperatively.

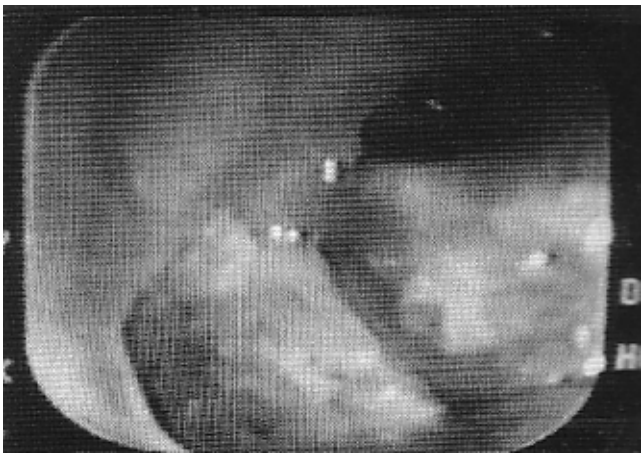

Fig.(2) : Endoscopic picture for a case of perforated duodenal ulcer with disappearance of omental plug, 4 days postoperatively.

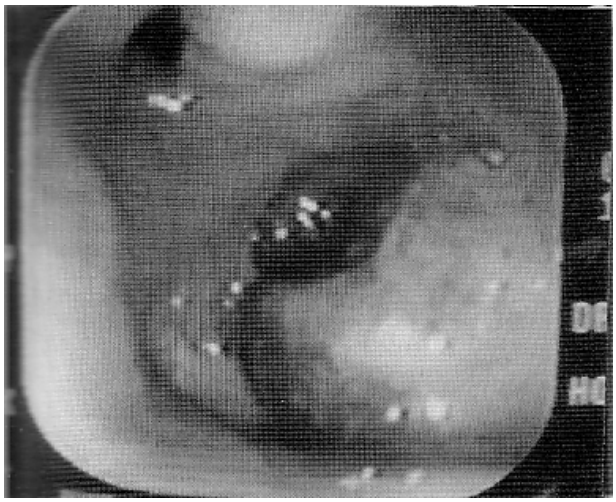

Fig.(3) : Endoscopic picture for a case with persistant duodenal ulcer 24 months postoperatively.

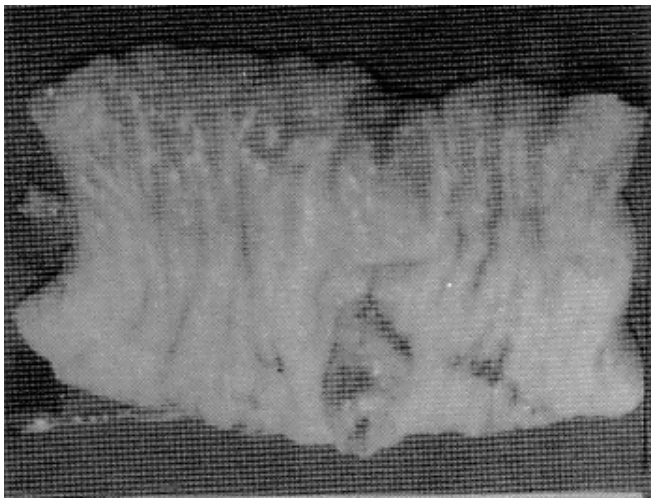

Fig.(4) : Specimen from the stomach of the dog in the area of omental plug shows discontinuity of the gastric mucosa 7 days postoperatively.

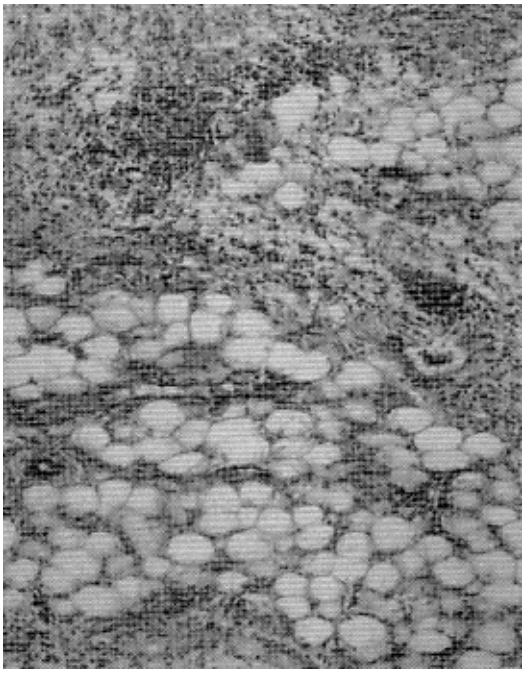

Fig.(5) : Microscopic picture showing omental plug transformation into granulation tissue in dog 7 days postoperatively.

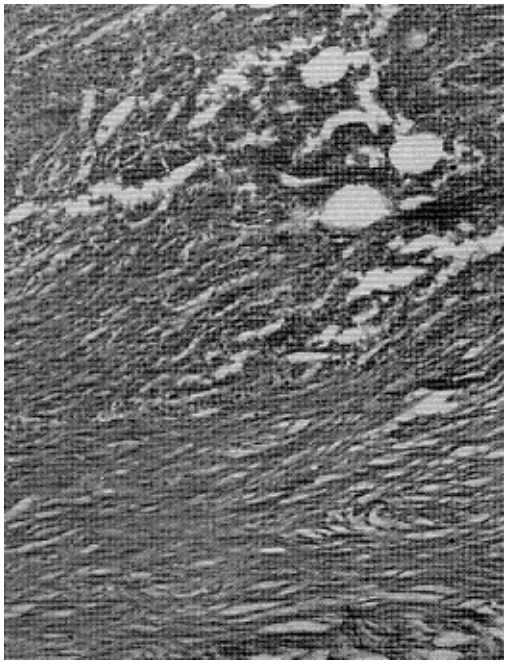

Fig.(6) : Microscopic picture for omental plug in another dog 4 weeks postoperatively replaced by dense fibrous tissue .

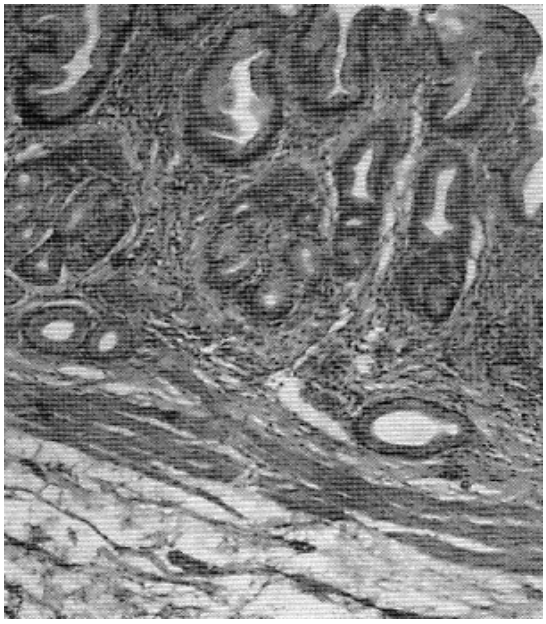

Fig.(7) : Microscopic picture for omental plug in another dog 8 weeks postoperatively with few bundles of smooth muscle fibres invading it and completely covered with normal mucosa

DISCUSSION

There are several options for dealing with a perforated peptic ulcer as simple closure for small perforation[5] , closure with omental patch[4] and use of definitive procedure[6-7] either performed by open surgery or with laparoscopy[8,9].

In applied part of our study, the operative time ranged from 45-60 minutes (A mean of 46.5 mins.). The average operative time consumed in simple closure of the perforated peptic ulcer was one hour as reported by Tanphilphat et al[10]

No operative mortality was reported in our study while the overall mortality after simple closure of perforated peptic ulcer was 6.2% [11,12], for suture plication was 6.5% and 9.6% for those undergoing definitive surgery[13].

In this study there was no reperforation nor leakage during the period of study that agreed with karanjia et al[4], who used omental plug in the treatment of duodenal ulcers more than 1 cm in diameter while the re-perforation rate in patients managed by simple closure was 9% [13].

On long term follow up of 18 patients , we found that 4 patients (22.2%) needed no further medical or surgical treatment, 9 patients (50%) responded well to medical treatments and 5 patients (27.8%) needed definitive procedure. Hardbrecht and Hamilton[13] stated that 64% of patients treated by simple sutures required definitive operation for control of persistant ulcer symptoms. Therefore, simple suture can not be considered as an ideal treatment for perforated peptic ulcers specially those with large size. Drury et al[14] studied 76 patients from two to five years after simple closure and found that 45% of the cases required a further definitive ulcer surgery. Reoperation rate on patients who were treated initailly by suture plication was 32%[15]. Cassell[16] reported that 20 percent of patients with acute peptic perforation required definitive surgery, whereas 43% of patients with chronic peptic ulcer who had perforated required definitive ulcer surgery.

In the experimental part of the present study, complete sealing of the big gastric holes were documented. The plug showed transformation into granulation and fibrous tissue, then integrated into the gastric wall and completely replaced with dense fibrous tissue and became covered with normal gastric mucosa. Few bundles of smooth muscle fibres were detected within the omental plug in all dogs after 8 weeks.

These findings were supported by Kondo & Suzuki[17], who studied the subsequent evolution of the greater omentum after using it to cover defect in the urinary bladder after partial resection in rabbits. They observed that , after a brief period , the greater omentum was integrated in the vesical wall and covered with normal mucosa. They also observed that bundles of muscle fibres progressively

developed within the transformed omentum. They suggested that the development of mucosa and muscle fibres, might be driven from totipotent mesenchymal cells located within the greater omentum.

Metopa & Colleagues [18] investigated the healing mechanism of perforated gastric ulcer in rats after plugging with greater omentum and found abundant collagen deposition in the transformed omental tissue. They reported that omental patch accelerated ulcer healing and inhibited ulcer recurrence due to the presence of growth factor beta-1.

We concluded that, omental plug technique is simple, excellent and life saving procedure especially in the elderly or critically ill patients with large perforated peptic ulcer but it has a limited value to the patients in term of definitive cure.

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