Planned Ventral Hernia with Absorbable Mesh: A Life-Saving Method in Relaparotomy for Septic Abdomen

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Background: Relaparotomy for abdominal sepsis is occasionally associated with wound edges necrosis and visceral edema prohibiting primary fascial closure. Planned ventral hernia with absorbable mesh is a life-saving method for abdominal wound management in such critically ill surgical patients.

Objective: Examine results of treatment of patients who underwent relaparotomy for septic abdomen and closure of abdominal wound with absorbable mesh.

Material and Method: A retrospective study of patients who underwent relaparotomy for abdominal sepsis and planned ventral hernia with absorbable mesh between 2004 and 2009 was performed. Data analysis included indication for relaparotomy, type of absorbable mesh used, results of treatment, and status of patients during the follow-up period.

Results: Twelve patients participated to the present study. Polyglycolic acid (Dexon) or polyglactin (Vicryl) mesh were used in six patients each. Final wound coverage was skin grafting in five patients (41.7%), skin flaps in one (8.3%), healing by secondary intention in five (41.7%), and human acellular dermal matrix and skin grafting in one (8.3%). One patient (8.3%) developed enterocutaneous fistula. There was no mortality. The hospital stay ranged from 17 to 201 days (mean 118 days).

Conclusion: Planned ventral hernia with absorbable mesh is a good alternative in the management of patients who undergo relaparotomy for abdominal sepsis. The procedure is life-saving for these patients.

Keywords: Abdominal sepsis, Relaparotomy, Absorbable mesh, Planned ventral hernia

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Abdominal sepsis is the most common indication for relaparotomy after major abdominal surgery. Recurrent or persistent abdominal sepsis may be responsible for 25-32% of patients who undergo relaparotomy. Mortality of these patients is seriously high, approaching 24-50%. Closure of the abdominal wall after relaparotomy may be problematic in some patients owing to massive visceral edema and/or necrosis with or without infection of fascia and muscles at abdominal wound edges. Inappropriate management of these complicated abdominal wounds at the end of relaparotomy may contribute to complications or even mortality. Primary fascial closure in such conditions may be harmful or even impossible. Forceful primary fascial closure may worsen the situation from severe pain, extension of necrosis of wound edges and abdominal compartment syndrome.

In order to avoid untoward consequences and improve survival, appropriate management of such complicated abdominal wounds is of utmost importance. Bridging of the abdominal wound edges with non-absorbable mesh has been recommended by some investigators. However, certain complications such as mesh infection and gastrointestinal fistula have rendered this method of abdominal wound management less favorable, especially in the potentially infected field. Absorbable mesh has been used and become a good alternative with satisfactory outcome as reported from previous studies. Its obvious advantage over the non-absorbable mesh is being a non-permanent foreign body that temporarily maintains abdominal wall integrity while the patient is recovering from secondary peritonitis. The excess intraabdominal fluid can permeate through the porosity of the mesh enhancing drainage of infected materials.
performed safely later when the patients fully recover which is approximately 6 months or more after skin grafting or healing with secondary intention\textsuperscript{15}.

The purpose of the present study was to examine results of treatment of patients who underwent relaparotomy for abdominal sepsis and abdominal wound management with absorbable mesh (planned ventral hernia) at King Chulalongkorn Memorial Hospital.

**Material and Method**

A retrospective study was performed in patients who underwent relaparotomy for abdominal sepsis and abdominal wound management with absorbable mesh at King Chulalongkorn Memorial Hospital, Bangkok, Thailand between January 1, 2004 and September 30, 2009. During the study-period, indications for relaparotomy for intraabdominal sepsis were one or both of the following: 1) persistent sepsis after the first operation in spite of intensive conservative treatment and 2) wound dehiscence or evisceration secondary from intraabdominal source of infection.

When relaparotomy was considered necessary, all the stitches of the previous abdominal fascial closure were removed. The abdominal cavity was entered and vigorously irrigated with warm saline solution. All the necrotic tissue, debris, pus, and collections were removed. Obvious perforation of the gastrointestinal tract or anastomotic leakage was closed with silk 2-0 or 3-0 sutures. When a leakage from the gastrointestinal tract was strongly suspected by the presence of gastrointestinal content in the abdominal cavity but no visible defect was detected owing to the walled-off mechanism of the omentum and abdominal viscera, no attempt was made to break or lysis the well-formed adhesion. A controlled fistula was then accepted by placing multiple drains in the abdominal cavity before closure with absorbable mesh. The authors used Penrose drains or silastic tube drains in all cases. The silastic tube drains were used when additional irrigation of the abdominal cavity via the silastic tube was planned.

After the intraabdominal procedures were completed, the abdominal wound was prepared for closure. The necrotic or infected fascial edge was debrided to a well-vascularized viable tissue. Some patients are managed by waiting for spontaneous healing with secondary intention (wound contraction and epithelialization). A large ventral hernia is usually unavoidable when using such method of abdominal wound management, so called by some investigators “planned ventral hernia”\textsuperscript{15}. Repairing of large ventral hernia can be performed safely later when the patients fully recover which is approximately 6 months or more after skin grafting or healing with secondary intention\textsuperscript{15}.
polyglycolic acid sutures (Fig. 3, 4). The abdominal wound was then managed by vacuum-assisted wound closure. First, the absorbable mesh was covered with a large piece of sterile plastic sheet with multiple holes. Then, a polyurethane sponge with 2 No. 18 nasogastric tubes embedded in it was placed over the plastic sheet. After that, the abdominal wound and the polyurethane sponge was sealed with a large sheet of plastic drape applying over the polyurethane sponge and the surrounding skin. The vacuum effect started when the nasogastric tubes were connected to the wall suction. The negative pressure of 80–100 mmHg was suitable for keeping the abdominal wound dry from permeation of fluid through the mesh.

The polyurethane sponge was changed and the wound was examined daily. The granulation tissue was allowed to grow and cover the mesh waiting for split-thickness skin grafting (Fig. 5, 6) or healing by secondary intention (wound contraction and epithelialization). In some cases, the final wound coverage was performed by skin flaps or the use of human acellular dermal matrix.

**Results**

During the 69-month period ending in September 2009, 12 patients entered into the present study. The age ranged from 17 to 72 years (mean 50 years). Eight patients (66.7%) were male and four (33.3%) were female. Indications for the first and relaparotomy with absorbable mesh placement are shown in Table 1. Polyglycolic acid (Dexon) mesh was used in six patients (50%) and polyglactin (Vicryl)
<table>
<thead>
<tr>
<th>Patients No.</th>
<th>Age (years)</th>
<th>Sex</th>
<th>Indication for 1st laparotomy</th>
<th>Indication for relaparotomy</th>
<th>Type of mesh used</th>
<th>Final wound coverage</th>
<th>Hospital stay (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>72</td>
<td>Male</td>
<td>Large ventral hernia repair with polypropylene mesh</td>
<td>Small bowel fistula</td>
<td>Dexon</td>
<td>Skin flap</td>
<td>17</td>
</tr>
<tr>
<td>2</td>
<td>48</td>
<td>Female</td>
<td>Blunt abdominal trauma</td>
<td>Small bowel fistula</td>
<td>Dexon</td>
<td>STSG</td>
<td>147</td>
</tr>
<tr>
<td>3</td>
<td>42</td>
<td>Female</td>
<td>Infected pancreatic necrosis</td>
<td>Persistent sepsis</td>
<td>Dexon</td>
<td>2nd healing</td>
<td>130</td>
</tr>
<tr>
<td>4</td>
<td>47</td>
<td>Male</td>
<td>Delayed treatment for stab wound of sigmoid colon</td>
<td>Persistent sepsis</td>
<td>Vicryl</td>
<td>STSG</td>
<td>52</td>
</tr>
<tr>
<td>5</td>
<td>41</td>
<td>Female</td>
<td>Pancreatic injury</td>
<td>Intraabdominal sepsis</td>
<td>Dexon</td>
<td>2nd healing</td>
<td>201</td>
</tr>
<tr>
<td>6</td>
<td>71</td>
<td>Female</td>
<td>Whipple operation for CA head of pancreas</td>
<td>Intraabdominal sepsis</td>
<td>Vicryl</td>
<td>STSG</td>
<td>120</td>
</tr>
<tr>
<td>7</td>
<td>40</td>
<td>Male</td>
<td>Blunt abdominal trauma infarction of pancreas</td>
<td>Massive small bowel</td>
<td>Dexon</td>
<td>STSG</td>
<td>172</td>
</tr>
<tr>
<td>8</td>
<td>65</td>
<td>Male</td>
<td>Closure of enterocutaneous fistula</td>
<td>Anastomotic leakage</td>
<td>Vicryl</td>
<td>2nd healing</td>
<td>120</td>
</tr>
<tr>
<td>9*</td>
<td>17</td>
<td>Male</td>
<td>Closure of enterocutaneous fistula</td>
<td>Entero-cutaneous fistula</td>
<td>Vicryl</td>
<td>2nd healing</td>
<td>180</td>
</tr>
<tr>
<td>10</td>
<td>57</td>
<td>Male</td>
<td>Radical total gastrectomy with distal pancreatectomy for CA stomach</td>
<td>Pancreatic fistula with sepsis</td>
<td>Vicryl</td>
<td>2nd healing</td>
<td>73</td>
</tr>
<tr>
<td>11</td>
<td>52</td>
<td>Male</td>
<td>Peptic perforation</td>
<td>Bile leakage with persistent sepsis</td>
<td>Vicryl</td>
<td>2nd healing</td>
<td>57</td>
</tr>
<tr>
<td>12</td>
<td>48</td>
<td>Male</td>
<td>Penetrating abdominal trauma</td>
<td>Missed injury, severe intraabdominal infection</td>
<td>Vicryl</td>
<td>HADM and STSG</td>
<td>150</td>
</tr>
</tbody>
</table>

STSG = split thickness skin grafting, 2nd healing = healing by secondary intention, HADM = human acellular dermal matrix, * = discharge with fistula
should be converted to enterostomy or colostomy. When perforation cannot be obviously demonstrated but its presence is strongly suspected, multiple drains are placed and controlled fistula is accepted. In almost all circumstances, surgeons usually encounter more or less a degree of fascial necrosis or fasciitis necessitating debridement. Debridement of rectus abdominis fascia should be performed adequately to a healthy viable tissue to prevent persistent infections or fasciitis, which we strongly believe is a major cause of treatment failure. Management of the abdominal wounds at the final step is crucial. A common mistake frequently practiced is to attempt forceful primary fascia to fascia abdominal closure with strong sutured. This method of abdominal closure is optimistically performed with great expectation of uneventful recovery without ventral hernia. However, a high price to pay for failure of such decision is progressive necrosis of rectus muscles and fascia from undue tension. Furthermore, excessive wound pain may compromise patients’ recovery. In addition, the risk of abdominal compartment syndrome still exists.

The use of synthetic mesh for closure of complicated abdominal wound has been advocated for several decades(7-11,18). Non-absorbable mesh has been used in the early period with variable outcome. The obvious disadvantage well-known to surgeons is gastrointestinal fistula from erosion of the mesh into the bowel lumen making its use no longer recommended in definitive management of open abdomen nowadays(7,10,11,15). Absorbable mesh becomes more popular for open abdomen management and is recommended by several investigators(11-15). Some investigators recently reported a satisfactory result of abdominal closure with components separation technique, a method first introduced for repair of a large ventral hernia(15,19,20). The authors have occasionally used this technique in good risk patients. The advantage of such a method is avoidance of future ventral hernia. However, the technique requires dissection of the skin and subcutaneous tissue from the abdominal fascia to both anterior axillary lines, which increases surgical trauma in high risk patients. Furthermore, the presence of infection may prohibit this method of abdominal wall management. Again, patients still encounter definite risk of abdominal compartment syndrome.

The authors believe that planned ventral hernia with absorbable mesh is a good alternative in such a situation. The necrotic or infected rectus abdominis fascia and muscles can be widely debrided...
to eliminate the possibility of persistent infection. Abdominal compartment syndrome is effectively prevented by the use of absorbable mesh. Excess intraabdominal fluid may be drained through the mesh resulting in rapid resolution of the visceral edema. Infected fluid is also drained through the mesh. A serious complication of planned ventral hernia well-recognized to surgeons is enterocutaneous or entero-atmospheric fistula. This complication is extremely difficult to manage and usually associated with a high mortality. The authors have encountered such a complication in one patient. To avoid the occurrence of fistula while the abdomen is open, awaiting for good granulation and split-thickness skin grafting or healing by secondary intention, the authors cautiously concentrate on the following details. Firstly, before placement of the absorbable mesh, be sure that no suture-lines of the bowel are exposed to the external environment. Secondly, before placement of the absorbable mesh, try to cover the abdominal viscera with omentum, if available. Thirdly, always covers the absorbable mesh with a multiple-hole polyvinyl plastic sheet before placing a dressing or sponge for vacuum-assisted closure. Finally, apply appropriate negative pressure to the abdominal wound, the authors use -80 mmHg to -100 mmHg in the presented patients. The authors think that the presented results of treatment is acceptable, with no mortality and only one occurrence of enterocutaneous fistula.

Recently, a novel biological material, human acellular dermal matrix has been used in open abdomen patients with increasing popularity. Its reported advantages are being a biocompatible material with a high success rate in the presence of infection. However, long-term study is required to clarify its applicability in patients with open abdomen. The authors used this material in the last patient of the presented case series with satisfactory outcome (patient No. 12 in Table 1).

In conclusion, planned ventral hernia with absorbable mesh is a life-saving method in dealing with a complicated abdominal wound during relaparotomy. The procedure is simple and safe in critically ill surgical patients. The authors strongly recommend this method as a good alternative when confronting these potentially lethal situations.

References
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การใช้ตาข่ายสังเคราะห์ชนิดละลายได้เป็นหน้ท้องในผู้ป่วยที่ได้รับการผ่าตัดช่องท้องซ้ำ เนื่องจากมีการติดเชื้อผ่าตัดช่องท้องซ้ำ

สุวิทย์ ศรีอัษฎาพร, สุกัญญา ศรีอัษฎาพร, รัฐพลี ภาคอรรถ, กฤตยา กฤตยากีรณ, ศุภฤกษ์ ปรีชายุทธ

วัตถุประสงค์: เพื่อศึกษาถึงผลของการใช้ตาข่ายสังเคราะห์ชนิดละลายได้เป็นหน้ท้องในผู้ป่วยที่ต้องรับการผ่าตัดซ้ำ เนื่องจากภาวะติดเชื้อซ้ำในช่องท้องและหรือที่แผลผ่าตัดภายหลังการผ่าตัดครั้งแรก

วัสดุและวิธีการ: เป็นการศึกษาตัวอย่างในผู้ป่วยที่ต้องรับการผ่าตัดซ้ำ เนื่องจากภาวะติดเชื้อในช่องท้องและหรือที่แผลผ่าตัดภายหลังการผ่าตัดครั้งแรก และได้รับการปิดแผลหน้าท้องด้วยตาข่ายสังเคราะห์ชนิดละลายได้ที่โรงพยาบาลจุฬาลงกรณ์ ตั้งแต่วันที่ 1 มกราคม พ.ศ. 2547 ถึงวันที่ 30 กันยายน พ.ศ. 2552 ข้อมูลที่ศึกษาได้แก่ ข้อมูลขั้นตอนการผ่าตัดซ้ำ, ชนิดของตาข่ายสังเคราะห์ชนิดละลายได้ที่ใช้, ผลการรักษา และการติดตามผู้ป่วยหลังจากออกจากโรงพยาบาล

ผลการศึกษา: มีผู้ป่วยในรายงานนี้ 12 ราย ผู้ป่วย 6 ราย ได้รับการปิดแผลหน้าท้องด้วยตาข่ายสังเคราะห์ชนิดละลายได้ polyglycolic acid หรือ dexon และอีก 6 ราย ได้รับการปิดแผลหน้าท้องด้วยตาข่ายสังเคราะห์ชนิดละลายได้ชนิด polyglyactin หรือ vicryl แผลหน้าท้องโดยการทำ skin graft ในผู้ป่วย 5 ราย (ร้อยละ 41.7), โดยการทำ skin flaps ในผู้ป่วย 1 ราย (ร้อยละ 8.3), โดยการปล่อยให้แผลผ่าตัดหายเอง 5 ราย (ร้อยละ 41.7) และโดยการใช้ human acellular dermal matrix และ skin graft 1 ราย (ร้อยละ 8.3) ผู้ป่วย 1 ราย (ร้อยละ 8.3) เกิดภาวะแทรกซ้อน enterocutaneous fistular ไม่มีผู้ป่วยรายใดเสียชีวิตระหว่างการผ่าตัดต่อโดยทั่วไป ระยะเวลาพักรักษาอยู่ระหว่าง 17 ถึง 201 วัน (เฉลี่ย 118 วัน)

สรุป: การใช้ตาข่ายสังเคราะห์ชนิดละลายได้เป็นหน้ท้องได้รับการผ่าตัดซ้ำ เนื่องจากภาวะติดเชื้อในช่องท้องและหรือแผลผ่าตัดซ้ำซึ่งจะทำให้การผ่าตัดครั้งแรกในช่องท้องยาก เราจึงมุ่งมั่นศึกษาความสามารถในการปิดแผลหน้าท้องด้วยตาข่ายสังเคราะห์ชนิดละลายได้ เพื่อให้ผู้ป่วยที่ต้องรับการผ่าตัดซ้ำในช่องท้อง ที่มีความเสี่ยงเป็นหน้าท้องแบบปกติได้รับการรักษาอย่างปลอดภัย หัวใจของการนี้จะช่วยประคับประคองให้ผู้ป่วยระบบตัวไปก่อน ที่มีเสี่ยงต่อการผ่าตัดซ้ำในช่องท้องซ้ำ ถือแม้ว่าจะต้องได้รับการผ่าตัดซ้ำซ้้อมแซมได้เล็กน้อยมากที่สุด แม้จะมุ่งเน้นในการลดภาระกิจตาม