A contrast study of Dermacyn on enterococcal irrigate to control intraoperative infection

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ABSTRACT

BACKGROUND: To evaluate antimicrobial properties of Dermacyn in abdominal infections, and to develop a new method for peritoneal lavage without using antibiotics.

METHODS: One hundred and ten patients suffering from intestinal perforation (abdominal closed injury), who had been treated with opened surgical repair or partial intestinal resection, were enrolled in this study. In the study group, Dermacyn was used for peritoneal lavage. During the same period, 102 patients with intestinal perforation of abdominal closed injury and opened repair or partial intestinal resection were enrolled as a control group. For the control group, metronidazole physiological saline was used for peritoneal lavage. Patents from both groups had a postoperative indwelling peritoneal drainage tube. Five objective indicators were studied and compared at 24, 48, and 72 hours: volume of drainage, drainage fluid culture, blood routine test, C-reactive protein, calcitonin and antibiotics dose.

RESULTS: There were no significant differences between the drainage volumes in two groups three days after the operation. There were significant differences in the nature of the drainage fluid, bacterial culture results, blood routine, C-reactive protein and procalcitonin between the two groups. In the experimental group, after the Dermacyn flushing, the average volume of peritoneal drainage fluid was reduced (from 30 to 5 mL) from 24 to 72 hours postoperatively.

CONCLUSIONS: The use of Dermacyn as an antibiotic agent for intraoperative peritoneal lavage was effective in reducing the risk of infection, due to its broad-spectrum bactericidal effect. Dermacyn could be used safely to perform peritoneal flushing to clean the operation site.


Key words: Dermacyn - Peritoneal lavage - Intestinal perforation - Intraabdominal infections.

Peritoneal lavage after abdominal surgery is often performed to clean the surgical site, eliminate possible contaminations, and remove the exuviation. Dermacyn is a stable free-radical solution initially introduced as an antibacterial agent for surfaces and instruments medical device and then found to be useful in clean surgeries.

Dermacyn disinfects while maintaining the health of the tissue and is capable of providing debridement, irrigation and moistening in the site of surgery. Moreover, it can reduce the need for antibiotics.

Materials and methods

From January 2010 to April 2014, 212 patients with intestinal perforation of abdominal closed injury that were treated with opened surgical repair or partial intestinal resection were randomly divided into two groups. Their ages ranged from 18 to 65 years old (average age 41.5 years). The male-to-female ratio was 3:4:1. Intraoperative peritoneal lavage was conducted in both groups. Dermacyn was used in the test group, and metronidazole physiological saline in the control group. There were
8 cases with colon rupture that were classified as the experimental group. Three among them were treated by repairing proximal colostomy and 5 were treated by a one-time repair.

One hundred and ten cases with intestinal perforation of abdominal closed injury, who had been treated with open surgical repair or partial intestinal resection, were selected as the test group. Antibiotics (the second generation cephalosporins and metronidazole) were empirically used preoperatively. During the operation, the fluid was pumped out and perforation of the digestive tract was closed using 4-0 absorbable suture. The area and abdominal cavity was washed with 500 mL normal saline, then the washing solution was absorbed completely. Dermacyn (300 mL) was used in flushing perforation local to make the abdominal cavity dispersion, without suction. Two rubber drainage tubes were placed in the lower part and the in pelvic cavity. Antibiotic therapy was not administered postoperatively.

One hundred and two patients with intestinal perforation of abdominal closed injury, who had been treated with opened surgical repair or partial intestinal resection, were selected as the control test group. Antibiotics (the second generation cephalosporins and metronidazole) were empirically used preoperatively. During the operation, the fluid was pumped out and perforation of the digestive tract was closed with 4-0 absorbable suture. Metronidazole physiological saline (500 mL) was applied for peritoneal lavage, then the washing solution was absorbed completely. Two rubber drainage tubes were placed in the repair site and the pelvic cavity, the abdominal wall was sutured layer by layer, and the cut was washed with normal saline layer by layer. Antibiotics (the second generation cephalosporins and metronidazole) were empirically used preoperatively, twice a day for three consecutive days.

The drainage volume were recorded at 24, 48, and 72 hours postoperatively, and the drainage samples obtained at each time point were used for bacterial culture. Blood routine tests, C-reactive protein evaluation and calcitonin evaluation were conducted and results were compared between the groups.

**Statistical analysis**

SPSS11.0 software was used for data analysis. Counting or measuring data were reported as mean±SD. Count data were compared between groups using the χ² test. Measurement data were compared between the two groups using the t-test.

**Results**

There were no significant differences in drainage volumes between the two groups three days after the operation (P>0.05). Drainage volumes were related to the degree of fluid absorption after peritoneal lavage. However, characteristics of the drainage fluid, bacterial culture results, blood routine, C-reactive protein and procalcitonin were significantly different (P<0.01). Drainage fluid collected from the test group was clear and the negative rate of bacterial culture was high, while the drainage fluid collected from the control group was murky and the positive rate of bacterial culture was 56%.

In the experimental group, after flushing the Dermacyn, the average volume of peritoneal drainage fluid was reduced (from 30 to 5 mL) from 24 to 72 hours postoperatively (Tables I, II). In the control group, the antibiotics were used until the seventh days after operation.

Postoperative mean value of peripheral white blood cells, average value of C-reactive protein and calcitonin in the test group were all significantly lower than those in the control

<table>
<thead>
<tr>
<th>TABLE I.—Intraoperative bacterial culture results of abdominal fluid in the two study groups.</th>
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<tbody>
<tr>
<td>Bacterial classification</td>
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<tr>
<td>--------------------------</td>
</tr>
<tr>
<td>Treatment group</td>
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<tr>
<td>Control group</td>
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</table>
group (Tables III). All studied indexes in the control group were significantly higher than those in the test group.

**Discussion**

The results showed that Dermacyin can effectively control secondary microbial contamination in abdominal cavity. It proved to be effective on different types of bacteria and other pathogenic microorganisms, therefore Dermacyin can reduce the need for antibiotics. Dermacyin is becoming the preferred agent for body cavity flushing and intraoperative sterilization.\(^1\)

Peritoneal lavage after surgery has always been the problematic part of surgeries. Usually large volumes of physiological saline are used for flushing and cleaning the abdominal cavity, however, this method has been found to be unreliable in some cases. Due to the nature of peritoneal lavage procedure, in most cases antibiotics are used without waiting for the results of bacterial culture. The mostly used antibiotics for peritoneal lavage are those effective on anaerobic bacteria and *Bacillus* sp. Use of Dermacyin as the non-antibiotic ingredient with its broad spectrum bactericidal effect can be effective in significantly reducing the risk of infection.

Our results showed that Dermacyin had the capability of destroying harmful microorganisms in abdominal cavity, while controlling the development of inflammation and reduce the inflammatory exudation. Related experiments confirmed that Dermacyin could inhibit the degranulation phenomenon of mast cells,\(^2\) which was one of the key steps in preventing intra-abdominal inflammatory response and intestinal adhesion formation. Mast cells are part of basophile family and are widely found on human skin, intestinal wall, and trachea tissue. Under antigen stimulation, mast cells normally release large amounts of granule-associated mediators (histamine and 5-hydroxytryptamine aka 5-HT), lipid source media (leukotrienes and platelet activating factor), cytokines (TNF, IL-1 and IFN) and trend factors (CCL and CXCL). Mast cells activation eventually triggers an inflammatory cascade producing exudation and adhesion.\(^3\) Our results confirmed the anti-inflammatory effects of Dermacyin.

Due to the broad-spectrum effect of Dermacyin on bacteria, it could be used intraoperatively without waiting for the results of bacterial culture.\(^4,\) \(^5\) Dermacyin provided promising results in reducing the occurrence of abdominal infection, and reduced the need for antibiotics, therefore decreased the risk of microbial resistance to antibiotics.\(^6,\) \(^8\)

**Conclusions**

Our results confirmed that the intraoperative use of Dermacyin reduced the need for antibi-

## Table II.—Postoperative volume of drainage and bacterial culture results at 24, 48, and 72 hours in the two groups.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Treatment group (N.=110)</th>
<th>Control group (N.=30)</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>24 h</td>
<td>48 h</td>
</tr>
<tr>
<td>Average volume of drainage (mL)</td>
<td>120</td>
<td>60</td>
</tr>
<tr>
<td>Positive cases of bacteria culture (N.)</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

## Table III.—Changes in white blood cells, C-reactive protein and calcitonin at 24, 48, and 72 hours after the operation.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Treatment group (N.=110)</th>
<th>Control group (N.=30)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>24 h</td>
<td>48 h</td>
</tr>
<tr>
<td>White blood cells (×10⁹)</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>C-reactive protein (ng/mL)</td>
<td>0.36</td>
<td>0.2</td>
</tr>
<tr>
<td>Calcitonin (mg/L)</td>
<td>7.5</td>
<td>4</td>
</tr>
</tbody>
</table>

Calcitonin: tested by immune turbidity, normal value 0–10 mg/L; C-reactive protein: tested by immunofluorescent, normal value 0–0.5 ng/mL.
otics. We only applied antibiotics once before operation as a preventive measure. Dermacyn, also reduced the immune response in the acute phase of inflammation caused by microbial infection, and prevented the secondary damage to liver and kidney. Use of Dermacyn in surgery is convenient, simple and preferred peritoneal washing method with no obvious adverse effects. The relatively low permeability of Dermacyn destroys microorganisms, making its use ideal in tumor removal surgeries. It can replace distilled water and saline for cleaning the operation field.

References


Conflicts of interest.—The authors certify that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript.

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