How to Use Antibiotics in Abdominal Injury Patients?

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FOCUS on Abdominal Injury
Trial of Short-Course Antimicrobial Therapy for Intraabdominal Infection

Prospective open-label randomized multicenter trial

✓ Experimental group
  - 4 full-days of antimicrobial therapy

✓ Control group
  - 2 days after the resolution of SIRS
518 Patients were enrolled and underwent randomization

260 Were assigned to control group
189 Received assigned intervention
71 Did not receive assigned intervention
26 Received more treatment than required on basis of physiological findings, but for <10 days total
35 Received treatment for >10 days
6 Had new surgical-site infection
8 Had recurrent intraabdominal infection
1 Had infectious disease owing to extra-abdominal infection
20 Had no identifiable reason to receive >10 days of treatment
10 Received therapy for too few days for no identifiable reason

258 Were assigned to experimental group
211 Received assigned intervention
47 Did not receive assigned intervention owing to >5 days of treatment
16 Had ongoing elevated white-cell count
12 Had gastrointestinal dysfunction
6 Had no identifiable reason to receive >5 days of treatment
2 Had persistent fever
2 Had new surgical-site infection
7 Had recurrent intraabdominal infection
1 Had extraabdominal infection
1 Withdrew consent after receiving antibiotic therapy

260 Were included in 30-day follow-up

257 Were included in 30-day follow-up

260 Were included in primary intention-to-treat analysis
189 Were included in evaluation of patients who adhered to study protocol

257 Were included in primary intention-to-treat analysis
211 Were included in evaluation of patients who adhered to study protocol
<table>
<thead>
<tr>
<th>Variable</th>
<th>Control Group (n=260)</th>
<th>Experimental Group (n=257)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary outcome, n (%)</td>
<td>58 (22.3)</td>
<td>56 (21.8)</td>
<td>0.92</td>
</tr>
<tr>
<td>Surgical-site Infection</td>
<td>23 (8.8)</td>
<td>17 (6.6)</td>
<td>0.43</td>
</tr>
<tr>
<td>Recurrent intraabdominal infection</td>
<td>36 (13.8)</td>
<td>40 (15.6)</td>
<td>0.67</td>
</tr>
<tr>
<td>Time to event</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diagnosis of surgical-site infection</td>
<td>15.1 ± 0.6</td>
<td>8.8 ± 0.4</td>
<td>&lt;0.001</td>
</tr>
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<td>Diagnosis of recurrent intraabdominal infection</td>
<td>15.1 ± 0.5</td>
<td>10.8 ± 0.4</td>
<td>&lt;0.001</td>
</tr>
<tr>
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<td>Control Group (n=260)</td>
<td>Experimental Group (n=257)</td>
<td>P Value</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
<td>------------------------</td>
<td>-----------------------------</td>
<td>---------</td>
</tr>
<tr>
<td>Primary outcome: surgical-site infection, recurrent intraabdominal infection, or death — no. (%)</td>
<td>58 (22.3)</td>
<td>56 (21.8)</td>
<td>0.92</td>
</tr>
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<td>40 (15.6)</td>
<td>0.67</td>
</tr>
<tr>
<td>Death</td>
<td>2 (0.8)</td>
<td>3 (1.2)</td>
<td>0.99</td>
</tr>
<tr>
<td>Time to event — no. of days after index source-control procedure</td>
<td></td>
<td></td>
<td></td>
</tr>
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<td>Death</td>
<td>19.0±1.0</td>
<td>18.5±0.5</td>
<td>0.66</td>
</tr>
<tr>
<td>Secondary outcome</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surgical-site infection or recurrent intraabdominal infection with resistant pathogen — no. (%)</td>
<td>9 (3.5)</td>
<td>6 (2.3)</td>
<td>0.62</td>
</tr>
<tr>
<td>Site of extraabdominal infection — no. (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any site†</td>
<td>13 (5.0)</td>
<td>23 (8.9)</td>
<td>0.11</td>
</tr>
<tr>
<td>Urine</td>
<td>10 (3.8)</td>
<td>13 (5.1)</td>
<td>0.65</td>
</tr>
<tr>
<td>Blood</td>
<td>3 (1.2)</td>
<td>5 (1.9)</td>
<td>0.71</td>
</tr>
<tr>
<td>Lung</td>
<td>3 (1.2)</td>
<td>3 (1.2)</td>
<td>0.99</td>
</tr>
</tbody>
</table>

**Secondary outcome**

Duration of outcome – days, Median(Interquartile range)

- Antimicrobial therapy for index infection: 8(5-10) vs. 4(4-5), p <0.001
- Antimicrobial-free days at 30 days: 21(18-25) vs. 25(21-26), p <0.001

*Plus–minus values are means ±SE.
†Some patients had extraabdominal infections at more than one site.

Trial of Short-Course Antimicrobial Therapy for Intraabdominal Infection

In patients with intraabdominal infections who had undergone an adequate source control, the outcomes after fixed-duration antibiotic therapy (4d) were similar to those after a longer course of antibiotics (8d).
Prophylactic antibiotics for penetrating abdominal trauma (Review)

Review content assessed as up-to-date: 16 January 2013
Should prophylactic antibiotics be used in patients with penetrating abdominal trauma?

Single pre-operative broad spectrum antibiotic dose, with aerobic and anaerobic cover (up to 24 hours) only in the event of a hollow viscus perforation existance. (Level I)
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There is currently no information from randomized controlled trials to support or refute the use of antibiotics for patients with penetrating abdominal trauma.
Should prophylactic antibiotics be used in patients with penetrating abdominal trauma?

There is currently no information from randomized controlled trials to support or refute the use of antibiotics for patients with penetrating abdominal trauma.
Should prophylactic antibiotics be used in patients with penetrating abdominal trauma?

Recommend a randomised controlled trial

Antibiotic Use ↓
Clinical Practice Guideline for the Use of Antibiotics in Abdominal Trauma Patients
- Korean Society of Acute Care Surgery 2015
Selected Guideline
Guidelines for the Prevention of Infections Associated With Combat-Related Injuries: 2011 Update

Endorsed by the Infectious disease Society of America and the Surgical Infection Society
Prophylactic antibiotic use in penetrating abdominal trauma: An Eastern Association for the Surgery of Trauma practice management guideline 2012

Stephanie R. Goldberg, MD, Rahul J. Anand, MD, John J. Como, MD, Tracey Dechert, MD, Christopher Dente, MD, Fred A. Luchette, MD, Rao R. Ivatury, MD, and Therese M. Duane, MD
2013 WSES guidelines for management of intra-abdominal infections

Grade of Evidence (Grade A~D)

<table>
<thead>
<tr>
<th>Grade</th>
<th>Evidence</th>
<th>Methodology</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>High</td>
<td>RCT</td>
</tr>
<tr>
<td>B</td>
<td>Moderate</td>
<td>Downgraded RCTs or upgraded observational studies</td>
</tr>
<tr>
<td>C</td>
<td>Low</td>
<td>Well-done observational studies with control RCTs</td>
</tr>
<tr>
<td>D</td>
<td>Very low</td>
<td>Downgraded controlled studies or expert opinion based on other evidence</td>
</tr>
</tbody>
</table>

Grade of Recommendation (Grade 1~2)

Grade 1: strong recommendation / Grade 2: weak recommendation
<table>
<thead>
<tr>
<th>Grade</th>
<th>Recommendation</th>
<th>Evidence Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>1A</td>
<td>Strong</td>
<td>High-quality</td>
</tr>
<tr>
<td>1B</td>
<td>Strong</td>
<td>Moderate-quality</td>
</tr>
<tr>
<td>1C</td>
<td>Strong</td>
<td>(very) Low-quality</td>
</tr>
<tr>
<td>2A</td>
<td>Weak</td>
<td>High-quality</td>
</tr>
<tr>
<td>2B</td>
<td>Weak</td>
<td>Moderate-quality</td>
</tr>
<tr>
<td>2C</td>
<td>Weak</td>
<td>(very) Low-quality</td>
</tr>
</tbody>
</table>
Who is indicated for antibiotic therapy?

Patients with abdominal trauma who should undergo surgery need preoperative prophylactic antibiotics. (IA)

We recommend not to use antibiotics who do not need surgery. (IA)
Who is indicated for antibiotic therapy?

Patients with abdominal trauma who should undergo surgery need preoperative prophylactic antibiotics. (IA)

We recommend not to use antibiotics who do not need surgery. (IA)
M/54
Traffic accident (Driver)
HD #1

WBC 13,300 /uL

AST/ALT : 312/214 IU/L
Who is indicated for antibiotic therapy?

Patients with abdominal trauma who should undergo surgery need preoperative prophylactic antibiotics. (IA)

We recommend not to use antibiotics who do not need surgery. (IA)
Who is indicated for antibiotic therapy?

Patients with abdominal trauma who should undergo surgery need preoperative prophylactic antibiotics. (IA)

We recommend **not to use** antibiotics who do not need surgery. (IA)
Antibiotics should be administrated as soon as possible after injury. (1C)
Time to first antibiotic use

Antibiotics should be administrated as soon as possible after injury. (1C)
Duration of antibiotic therapy
Duration of antibiotic therapy

Source Control
In the absence of hollow viscus injury, no additional doses of antibiotics are needed. (1A)
Duration of antibiotic therapy (I)

In the absence of hollow viscus injury, no additional doses of antibiotics are needed. (1A)
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If hollow viscus is repaired within 12 hours, antibiotics should be continued for no more than 24 hours. (1A)
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If hollow viscus is *repaired within 12 hours*, antibiotics should be continued for no more than 24 hours. (1A)
If hollow viscus is repaired within 12 hours, antibiotics should be continued for no more than 24 hours. (1A)
If hollow viscus injury is repaired after 12 hours, antibiotics should be limited to 7 days. (2C)
If hollow viscus injury is repaired after 12 hours, antibiotics should be limited to 7 days. (2C)
If hollow viscus injury is **repaired** after 12 hours, antibiotics should be limited to 7 days. (2C)
If hollow viscus injury is repaired after 12 hours, antibiotics should be limited to 7 days. (2C)
Antibiotics can be used for more than 7 days if hollow viscus injury is incompletely repaired or persistent clinical sign in patients with traumatic abdominal injury. (2C)
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Enteroatmospheric fistula
Pancreas fistula
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Antibiotics can be used for more than 7 days if hollow viscus injury is incompletely repaired or persistent clinical sign in patients with traumatic abdominal injury. (2C)
What is appropriate antibiotics?

Broad-spectrum aerobic and anaerobic coverage antibiotics, is preferred as initial antibiotics in abdominal injury. (1A)
Broad-spectrum aerobic and anaerobic coverage antibiotics, is preferred as initial antibiotics in abdominal injury. (1A)
What is appropriate antibiotics?

We recommend 2\textsuperscript{nd} generation cephalosporin as initial antibiotics.(1B)
We recommend 2nd generation cephalosporin as initial antibiotics.(1B)
In patients admitted with hemorrhagic shock, administered dose of antibiotics may be increased twofold or threefold and repeated after transfusion of every 10 units of blood unit until there is no further blood loss. (2B)
Special Consideration: Abdominal trauma patients with hemorrhagic shock

In patients admitted with hemorrhagic shock, administered dose of antibiotics may be increased twofold or threefold and repeated after transfusion of every 10 units of blood unit until there is no further blood loss.(2B)
Special Consideration: Abdominal trauma patients with hemorrhagic shock

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OPEN ABDOMEN
Damage Control Surgery

Damage Control Surgery → Resuscitation → Definitive Surgery
Damage Control Surgery

- Damage Control Surgery
- Resuscitation
- Definitive Surgery
OPEN ABDOMEN
Lethal Triad

- Hypothermia
- Acidosis
- Coagulopathy
Damage Control Surgery

Damage Control Surgery

Resuscitation

Definitive Surgery
OPEN ABDOMEN

ANTIBIOTICS ?
Open abdomen

Failure to identify any articles specifically addressing the role of prophylactic antibiotics (still using antibiotics until abdomen was closed)

*J Trauma Acute Care Surg* 2012;73:S321-S325
Open abdominal management after damage-control laparotomy for trauma: A prospective observational American Association for the Surgery of Trauma multicenter study

✓ Prospective Observational Multi-institutional study

✓ Sponsored by AAST (American Association for the Surgery of Trauma)
Predictors of Failure to Achieve Native Fascial Closure of the Open Abdomen During Initial Hospitalization for Trauma

TABLE 5. Predictors of Failure to Achieve Native Fascial Closure of the Open Abdomen During Initial Hospitalization for Trauma

<table>
<thead>
<tr>
<th>Method, Forward LR</th>
<th>AOR (95% CI)</th>
<th>p</th>
<th>Cumulative R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. reexplorations</td>
<td>1.34 (1.15-1.57)</td>
<td>&lt;0.001</td>
<td>0.142</td>
</tr>
<tr>
<td>Intra-abdominal abscess/sepsis</td>
<td>2.43 (1.22-4.83)</td>
<td>0.011</td>
<td>0.186</td>
</tr>
<tr>
<td>BSIs</td>
<td>2.60 (1.18-5.70)</td>
<td>0.017</td>
<td>0.214</td>
</tr>
<tr>
<td>Acute renal failure</td>
<td>2.31 (1.19-4.46)</td>
<td>0.013</td>
<td>0.236</td>
</tr>
<tr>
<td>Enteric fistula</td>
<td>6.38 (1.23-32.86)</td>
<td>0.027</td>
<td>0.258</td>
</tr>
<tr>
<td>ISS &gt; 15</td>
<td>2.48 (1.06-5.85)</td>
<td>0.037</td>
<td>0.276</td>
</tr>
</tbody>
</table>

Model R² = 0.276; c statistic = 0.76 (0.71-0.81). Other variables in model: age, sex, chest AIS, pH, lactate, estimated blood intraoperative blood loss, acidosis, intraoperative blood products, operating room fluid balance, number of packs used, small-bowel resection, large-bowel resection, bowel left in di. AOR, adjusted odds ratio; BSI, blood stream infection; CI, confidence interval; ISS, Injury Severity Score.
### TABLE 3. Operative Intervention in Patients With Open Abdomens After Trauma Surviving 48 Hours

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Total (N=517)</th>
<th>DPC (n=338)</th>
<th>NPC (n=179)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abdominal packing, n (%)</td>
<td>363/517 (70.2)</td>
<td>240/338 (71.0)</td>
<td>123/179 (68.7)</td>
<td>0.843</td>
</tr>
<tr>
<td>No. packs, mean (SD)</td>
<td>3.9 (5.2)</td>
<td>3.7 (4.5)</td>
<td>4.5 (6.2)</td>
<td>0.161</td>
</tr>
<tr>
<td>Gastric injury repair, n (%)</td>
<td>62/517 (12.0)</td>
<td>39/338 (11.5)</td>
<td>23/179 (12.8)</td>
<td>0.663</td>
</tr>
<tr>
<td>Diaphragm injury repair, n (%)</td>
<td>68/517 (13.2)</td>
<td>42/338 (12.4)</td>
<td>26/179 (14.5)</td>
<td>0.502</td>
</tr>
<tr>
<td>Bowel resection, n (%)</td>
<td>196/517 (37.9)</td>
<td>118/338 (34.9)</td>
<td>78/179 (43.6)</td>
<td>0.053</td>
</tr>
<tr>
<td>No. resections, mean (SD)</td>
<td>1.5 (0.1)</td>
<td>1.4 (0.8)</td>
<td>1.6 (0.9)</td>
<td>0.109</td>
</tr>
<tr>
<td>Small bowel resections, n (%)</td>
<td>109/517 (21.1)</td>
<td>68/338 (20.4)</td>
<td>41/179 (22.9)</td>
<td>0.120</td>
</tr>
<tr>
<td>Large bowel resections, n (%)</td>
<td>87/517 (16.8)</td>
<td>50/338 (14.8)</td>
<td>37/179 (20.7)</td>
<td>0.123</td>
</tr>
<tr>
<td>Bowel left in discontinuity, n (%)</td>
<td>120/517 (23.2)</td>
<td>67/338 (19.8)</td>
<td>53/179 (29.6)</td>
<td>0.031</td>
</tr>
<tr>
<td>Hepatic intervention, n (%)</td>
<td>196/517 (37.9)</td>
<td>131/338 (38.8)</td>
<td>65/179 (36.3)</td>
<td>0.586</td>
</tr>
<tr>
<td>Packing</td>
<td>91/517 (17.6)</td>
<td>63/338 (18.6)</td>
<td>28/179 (15.6)</td>
<td>0.326</td>
</tr>
<tr>
<td>Hepatorrhapy</td>
<td>67/517 (13.0)</td>
<td>46/338 (13.6)</td>
<td>21/179 (11.7)</td>
<td>0.713</td>
</tr>
<tr>
<td>Resection</td>
<td>18/517 (3.5)</td>
<td>11/338 (3.3)</td>
<td>7/179 (3.9)</td>
<td>0.702</td>
</tr>
<tr>
<td>Other</td>
<td>20/517 (3.9)</td>
<td>11/338 (3.3)</td>
<td>9/179 (5.0)</td>
<td>0.251</td>
</tr>
<tr>
<td>Splenectomy, n (%)</td>
<td>122/517 (23.6)</td>
<td>78/338 (23.1)</td>
<td>44/179 (24.6)</td>
<td>0.702</td>
</tr>
<tr>
<td>Nephrectomy, n (%)</td>
<td>35/517 (6.8)</td>
<td>26/338 (7.7)</td>
<td>9/179 (5.0)</td>
<td>0.251</td>
</tr>
<tr>
<td>Vascular injury repair, n (%)</td>
<td>144/517 (27.9)</td>
<td>93/338 (27.5)</td>
<td>51/179 (28.5)</td>
<td>0.814</td>
</tr>
<tr>
<td>Thoracotomy, n (%)</td>
<td>105/517 (20.3)</td>
<td>53/338 (15.8)</td>
<td>52/179 (30.0)</td>
<td>0.326</td>
</tr>
</tbody>
</table>

Postoperative antibiotics, n (%) 291/517 (56.3) 198/338 (58.6) 93/179 (52.0) 0.149

DPC : definitive primary closure, NPC : Non-primary closure
Open abdomen

Failure to identify any articles specifically addressing the role of prophylactic antibiotics (still using antibiotics until abdomen was closed)

*J Trauma Acute Care Surg* 2012;73:S321-S325

Prophylactic antibiotics should be administered preoperatively. The duration should be no longer than 24 hours.

Open abdomen

Open early! Close early!
In hollow viscus injury patients...

✓ Prophylactic antimicrobials have an important role.
✓ Broad-spectrum coverage is important.

HOWEVER...

✓ Do not use no longer than 24 hrs of antibiotics
✓ Source control is the most important treatment for intra-abdominal infection.