The question of if, and when, to perform a relook laparotomy is an on-going debate between surgeons and critical care physicians with no clear answer to support the ideal timing thereof.

In emergency surgery most patients are compromised by their physiological status, with the acute pathology determining their need for a laparotomy. In elective surgery a planned relook laparotomy is usually done either to control hemorrhage, ascertain the viability of tissue or repair an anastomotic leak.

Emergency laparotomies are often done in:

- Abdominal trauma with hemodynamic instability, acute abdomen or pneumoperitonium
- Abdominal spesis
- Bowel obstruction
- GIT hemorrhage that cannot be controlled by endoscopic means
- Bowel ischemia.

The mortality in patients undergoing emergency surgery is significantly higher than those undergoing elective surgery.

**THE PLANNED RELOOK**

The decision to do a planned relook laparotomy will sometimes be determined during the initial operation due to the pathology or physiological status of the patient.
Conditions that might indicate a planned relook include:

- Damage control in severe trauma or acute and emergency surgery.
- Severe sepsis.
- Bowel ischemia.
- GIT hemorrhage that cannot be controlled by endoscopic, endovascular or surgical means.
- Conditions that require multiple debridements eg. necrotising pancreatitis.
- Abdominal compartment syndrome.
- Controversially, there are conditions where attempts to avoid the creation of a stoma at initial operation. i.e. perforated diverticulitis or perforated volvulus.

In some cases definitive surgery can be done at the initial setting and the patient can be closely monitored for indications for a relook on demand.

**DAMAGE CONTROL IN TRAUMA AND ACUTE EMERGENCY SURGERY**

The role of damage control in trauma is well established to avoid the lethal triad of acidosis, coagulopathy and hypothermia. Abbreviated surgery is done to stop the bleeding and limit contamination. In non-trauma general surgery the role of damage control or scheduled relook laparotomy is not as clear, but gradually the principles were adopted by trauma surgeons that also did emergency and acute surgery.

Damage control surgery can be divided into different phases:

The pathophysiology of, and management principles for damage control in trauma and the bleeding acute emergency surgery are the same. Namely; arrest the bleeding and correct the coagulopathy.

In septic shock the aetiology is inflammatory and the aim resuscitation according to the Surviving Sepsis guidelines, with fluids, inotropes and early antibiotics and appropriate drainage.
Despite there being only Level III and IV evidence for the existing for the application of damage control surgery in acute emergency surgery the incidence over the last decade has increased drastically\textsuperscript{5}.

Table 1.

<table>
<thead>
<tr>
<th>Phase</th>
<th>Trauma surgery</th>
<th>Haemorrhagic shock</th>
<th>Septic shock</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Initiation of goal-directed haemostatic resuscitation without delaying surgery</td>
<td>Initiation of goal-directed haemostatic resuscitation without delaying surgery</td>
<td>Preoperative resuscitation with Fluids and vasoconstrictors</td>
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<td></td>
<td>Hypothermia correction</td>
<td>Antibiotic administration</td>
<td></td>
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<tr>
<td>1</td>
<td>Identification</td>
<td>Identification</td>
<td>Identification</td>
</tr>
<tr>
<td></td>
<td>Injury pattern</td>
<td>Pathology</td>
<td>Pathology</td>
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<tr>
<td></td>
<td>Physiology</td>
<td>Physiology</td>
<td>Physiology</td>
</tr>
<tr>
<td>2</td>
<td>Control haemorrhage</td>
<td>Control haemorrhage</td>
<td>Decontamination</td>
</tr>
<tr>
<td></td>
<td>Control contamination</td>
<td></td>
<td>Sepsis source control</td>
</tr>
<tr>
<td>3</td>
<td>Reassessment during surgery</td>
<td>Reassessment during surgery</td>
<td>Reassessment during surgery</td>
</tr>
<tr>
<td>4</td>
<td>Physiological restoration in intensive care</td>
<td>Physiological restoration in intensive care</td>
<td>Physiological restoration in intensive care</td>
</tr>
<tr>
<td></td>
<td>Optimisation of haemodynamics</td>
<td>Optimisation of haemodynamics</td>
<td>Optimisation of haemodynamics</td>
</tr>
<tr>
<td></td>
<td>Correction of acidosis, hypothermia and coagulopathy</td>
<td>Correction of acidosis, hypothermia and coagulopathy</td>
<td>Correction of acidosis, hypothermia and coagulopathy</td>
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<tr>
<td></td>
<td>Optimisation and support of vital organs</td>
<td>Optimisation and support of vital organs</td>
<td>Optimisation and support of vital organs</td>
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<tr>
<td>5</td>
<td>Definitive repair abdominal wall closure</td>
<td>Definitive repair Abdominal wall closure</td>
<td>Definitive repair Abdominal wall closure</td>
</tr>
</tbody>
</table>

Fig 1.
Damage control surgery is associated with a higher morbidity, prolonged hospital stay and higher cost but improved mortality if used for the correct indications. Care should be taken against overzealous use.

**SEVERE SEPSIS**
Despite advances in diagnosis, surgery, antimicrobial therapy and intensive care the management of patients with severe intra-abdominal sepsis remain a challenge with mortality rates of 30-60% being reported.

The Intensive Care Unit (ICU) at Charlotte Maxeke Johannesburg Academic Hospital published retrospective study in 2010. Over two years 54 patients with severe intra-abdominal sepsis were reported. Only 14 survived with a mortality of 74.1%. Predictive of adverse outcome were; longer ICU stay, higher APACHE II scores, number of relooks (survivors had four or less relooks), open vs closed abdomens (open abdomens did worse), Total parenteral nutrition, amount of blood transfusion, inotropic support and dialysis.

The CIAOW study (Complicated intra-abdominal infections worldwide observational study) published in 2014 found that there is has been a decrease in the overall mortality to 10.5%, however in patients with severe sepsis and septic shock the mortality was still 36.5%.

Risk factors were reported as advanced age, co-morbidities, immunosuppressive agents, AIDS, organ failure, underlying pathology and patients genetic composition.

Two strategies in the management of these difficult patients have been described:

- Re-laparotomy on demand determined by the patients clinical condition
- Planned re-laparotomy in 36-48hrs after initial surgery (decision made at initial surgery).
The debate of re-laparotomy on demand vs. planned has been on going with little data to support either way. In 2007, Van Ruler compared “planned vs. on-demand relook laparotomy” and found that patients in the on-demand relook group did not have a higher mortality or peritonitis related morbidity compared than those who had planned relooks. The latter did have fewer procedures, shorter hospital stay and reduced costs. The difficulty is in identifying the patient that needs the relook laparotomy.

Several studies have looked at possible variables that can predict at the initial surgery those that may benefit from a relook laparotomy. Van Ruler et al in 2007, looked at 219 patients who had an emergency laparotomy for secondary peritonitis. Findings at the initial surgery and the origin of the sepsis were found to be poor predictors while signs of persistent organ dysfunction was a more accurate predictor.

Koperna et al. in 2000, looked at 105 patients that needed a relook laparotomy out of 523 patients with secondary peritonitis. They reported no difference in mortality in the planned vs. on-demand relook laparotomies. Relook laparotomies done more than 48hrs after the initial surgery had a significantly higher mortality rate (76.5% vs. 28%).

A prospective trial looking at the management of intra-abdominal sepsis in critically ill patients with APACHE II scores > 10 showed a mortality of 31% with a single laparotomy and 42% on patients with multiple laparotomies.

The relook laparotomies may also be due the patients general condition and the severity of the sepsis. MODS was used as an indication for relook laparotomy. MODS is associated with a high mortality.

Studies proved that the greatest rate of resolution of sepsis happened after the initial re-operation (43%) and then decreased with every re-operation thereafter (25% with 2nd and 7% with 3rd). Repeat procedures that were directed had no difference in mortality but did show significant clinical improvement.
Pusajo et al produced these indicators as possible predictors\textsuperscript{14}.

### Table 2.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Score</th>
</tr>
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<tbody>
<tr>
<td>Emergency surgery at primary operation</td>
<td>3</td>
</tr>
<tr>
<td>Respiratory Failure</td>
<td>2</td>
</tr>
<tr>
<td>Renal Failure</td>
<td>2</td>
</tr>
<tr>
<td>Ileus (from 72 hrs after surgery)</td>
<td>4</td>
</tr>
<tr>
<td>Abdominal pain (from 48 hrs after surgery)</td>
<td>5</td>
</tr>
<tr>
<td>Wound infection</td>
<td>8</td>
</tr>
<tr>
<td>Consciousness alterations</td>
<td>2</td>
</tr>
<tr>
<td>Symptoms appearing after the fourth day from surgery</td>
<td>6</td>
</tr>
</tbody>
</table>

A patient with a score of less than 10 was observed. A score of 11-15 was investigated and the decision to re-operate or use interventional radiology was based on the outcome of the procedure, a score of > 20 mandated immediate relook laparotomy. A score of 16-20 invariably ended with a relook laparotomy despite investigations.

The predictive value of these guidelines remains to be confirmed. Presently there is no clear guide as to which patients will need a relook on demand for sepsis. If sepsis or multi-organ failure fails to improve, a relook laparotomy should be done earlier rather than later.

Interventional radiology for drainage of abdominal collections has reduced the need for relook laparotomy, however clinical condition should still dictate the most appropriate intervention.

**OPEN VS CLOSED ABDOMEN AND THE PLANNED RELOOK**

Depending on the local practice the abdomen may be closed or left open with a temporary closure. Disadvantages associated with early abdominal closure include; damage to the rectus fascia, inability to monitor fluid volume and type (bile, enteric contents) and increased risk for abdominal compartment syndrome.
With an open abdomen, abdominal compartment syndrome is avoided and abdominal fluid monitoring is possible. However bowel evisceration, inability to close the sheath and a higher fistula formation are the cost\textsuperscript{15}.

**BOWEL ISCHEMIA**
Acute mesenteric ischemia due to whatever cause often necessitates a planned relook. Questionable bowel viability and the high rate of abdominal compartment syndrome make a definitive procedure at initial surgery impossible. Relook is suggested at 36-48 hours.

**HEMORRHAGE**
Hemorrhage that requires packing in elective surgery is rare but well described. In emergency surgery a planned relook may be indicated in upper GIT hemorrhage, unidentified lower GIT hemorrhage or hemorrhage of a ruptured AAA. All of these might be associated with severe physiological insult and associated coagulopathy.

Abdominal packing, resuscitation with correction of the coagulopathy, acidosis and hypothermia followed by removal of the packs at a planned relook is suggested. There remains the risk of failing to adequately control the underlying haemorrhage.

**MULTIPLE DEBRIDEMENTS**
Relook laparotomies were historically used to remove infected and necrotic tissue and therefore remove the inflammatory focus. Less invasive management strategies including percutaneous drainage and minimally invasive necrosectomy has largely replaced repeated laparotomy.

**ABDOMINAL COMPARTMENT SYNDROME**
Abdominal Compartment Syndrome (ACS) is a surgical emergency and requires immediate decompression. It characterised by raised intra-abdominal pressures either due to pathology in the abdomen (primary) or extra-abdominal pathology (secondary).
ACS is defined as intra-abdominal pressures greater than 20mmHg with organ dysfunction:

- Renal dysfunction – decreased urine output due to pressure on renal vein.
- Hemodynamic instability – due to pressure on IVC and decreased venous return.
- Ventilation difficulty – due to the pressure on the diaphragm the tidal volumes will drop in pressure control ventilation or the pressures will go up in volume control ventilation due to a decreased compliance.

Abdominal compartment syndrome might also force the surgeon to leave the abdomen open at the initial operation or on demand if indicated. Medical management can initially be attempted, ie. sedate and paralyse the patient, Decompress the bowel with naso-gastric tube and enema, or tap ascites. Most patients will require a relook laparotomy, and will end up with an open abdomen and vacuum dressing.

CONCLUSION
Planned relooks are necessary in certain cases but are still associated with longer hospital stays and complications.

Relook on demand takes the clinical condition of the patient, and lack of clinical improvement into consideration but is associated with a higher mortality if the relook has been delayed too long.

REFERENCES


