

## Rectal Penetrating Injuries from Blast Trauma

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**Key words:** rectal trauma, blast injury, penetrating trauma, bombings, explosions

IMAJ 2002;4:557-558

Acts of terrorism are on the rise internationally. Terrorist bombings in Israel have become more "professional," as standard military explosives have become more prevalent and the selection of targets relies on more accurate intelligence gathering in order to maximize damage. Lately, suicide bombers have been using these high powered explosives with high mass components in order to intensify their effects.

Rectal injuries caused by high powered missiles without associated colon injuries are not common in military or civilian trauma [1]. To the best of our knowledge, rectal trauma caused by blast injury or bomb fragments has not been reported in the literature. We report two patients who suffered multiple injuries from a suicide bomb attack in Jerusalem. They both sustained penetrating rectal trauma caused by high mass shrapnel, in addition to multiple limb injuries, blast injuries and burns.

### Patient Descriptions

#### Patient 1

A 16 year old girl was brought to our admitting area after sustaining multiple injuries from a blast injury. She had been standing in the "Sbarro" pizzeria with her right side and back towards a suicide bomber who detonated a 10 kg bomb accompanied by a large amount of shrapnel. Upon arrival she was fully conscious, blood pressure was 125/85 mmHg and pulse was 85 per minute. There was tenderness and a laceration over the nose with a foreign body protruding through the skin and second-degree burns over the right side of her face. Ear examination revealed peripheral tear of the right tympanic membrane. Her abdomen was mildly distended, without tenderness. There was an entry wound in her lower right back. There were multiple entry sites of foreign bodies on the posterior aspect of both legs and a second-degree burn over the ventral aspect of her right arm.



**Figure 1.** Lateral X-ray of the left lower leg (patient 1) showing a compound fracture of the distal tibia and multiple metallic foreign bodies.

X-rays revealed a fracture of

the left distal tibia with multiple foreign bodies in both lower limbs [Figure 1]. A fracture of her nasal bone was also noted. Because of the entry site to her lower back, a triple-contrast computerized tomography scan was performed and revealed ex-



**Figure 2.** Triple-contrast CT scan of the pelvis (patient 1) revealing air surrounding the rectum (arrowhead) and extravasation of contrast material (arrow).

travasation of contrast material from the rectum [Figure 2]. In the operating room rectoscopy disclosed a foreign body lodged in the rectum, which was easily removed through the rectum. Laparotomy revealed no peritoneal contamination, the sigmoid colon was divided, the distal rectal stump copiously irrigated and then closed, and an end-sigmoid colostomy was fashioned. The rectal injury was not repaired. The distal tibia fracture underwent closed reduction and plastering, and multiple foreign bodies were removed.

Her postoperative course was uneventful and she was discharged on the eighth postoperative day. A barium enema performed 3 months later showed normal rectal mucosa and the patient underwent closure of the colostomy.

#### Patient 2

A 39 year old woman was admitted to our emergency room after sustaining multiple injuries in the same suicide bomb attack. She had also been standing in the "Sbarro" pizzeria with her back towards the suicide bomber. Upon arrival she was fully conscious, blood pressure was 115/80 mmHg and pulse was 83 per minute. There were a few shrapnel entry sites on the face and second-degree burns over the forehead. Her abdominal examination was normal. There was a deformity over her right arm and right calf with multiple shrapnel entry sites. There was an entry site over her right buttock. Rectal examination was positive for blood.

X-rays revealed multiple metallic fragments in both lower limbs, right arm and pelvis. Abdominal and pelvic CT scan showed air surrounding the rectum with extravasation of contrast material. Rectoscopy performed in the operating room revealed blood. Laparotomy showed a small amount of blood in

the pelvis, without evidence of other intra-abdominal injuries. A loop sigmoid colostomy was fashioned and the presacral space was drained. Again, the rectal injury was not repaired. The Gustillo type 3A open fractures of the right humerus and right tibia underwent unreamed nailing and multiple pieces of shrapnel were removed.

Her postoperative course was characterized by fever of 38.5°C. Abdominal and pelvic CT scan showed a 1.5 x 2 cm collection in the left pararectal space that was treated by broad-spectrum antibiotics with resolution of fever. She was discharged on postoperative day 19 in satisfactory condition and is currently awaiting closure of her colostomy.

### Comment

Trauma after explosions has traditionally been divided into primary, secondary and tertiary blast injury [2]. Primary blast injuries are caused by the sudden increase in air pressure and typically cause damage to gas-containing organs such as the lung, middle ear and bowel [2]. Secondary blast injuries occur when the intense release of energy propels bomb fragments and other debris to every direction, resulting in penetrating trauma. These irregularly shaped missiles deposit a large proportion of their pre-impact kinetic energy rapidly along wound tracts to produce tissue destruction. Damage caused by these fragments was considered minor relative to primary blast injury [3]. Tertiary blast injuries result from the victim's body being displaced by expanding gases. Other injuries encountered in blast victims are burns caused by hot gases or secondary fires, and crushing injuries from structural collapses.

The above-described suicide bombing attack has shed light upon some as yet unknown aspects of injuries inflicted by terrorist attacks. The kinetic energy of a fragment equals the mass multiplied by velocity to the second power. Conventional military explosives may create multiple fragments with initial velocities of up to 1,500 m/sec. Previous bombing attacks in Israel have included standard military anti-tank mines that usually contain metal nails. During the current wave of suicide bombings, the terrorists have used similar explosive devices containing relatively higher mass components such as bolts and nuts. These fragments are of high mass and high kinetic energy, and the damage they inflict at close range is therefore considerable. The fragments in both our patients caused fractures of long bones and penetrated the soft tissues of the buttock and back to enter the rectum. We believe injuries caused by this type of shrapnel should be treated as penetrating high velocity missiles in terms of index of suspicion, diagnostic workup, and treatment.

Primary repair is undoubtedly the treatment of choice for the majority of civilian gunshot wounds of the intraperitoneal colon. Various management options, including diverting colostomy, primary repair, presacral drainage and distal bowel washout, have been described for extraperitoneal rectal gunshot injuries. Primary rectal repair without fecal diversion is not considered a safe method due to the anatomic and technical difficulties associated with the

rectum. Therefore, and in spite of sporadic reports of primary transanal and transabdominal primary rectal repair, diverting colostomy is considered the mainstay of treatment of penetrating rectal injuries. There is probably no significance to the exact technique of diversion.

It is not well established whether distal bowel washout, primary rectal repair and presacral drainage are necessary adjuncts in managing these injuries. Some advocate a "simpler is better" approach [4], while others believe presacral drainage and distal washout are important adjuncts to the treatment of penetrating rectal trauma [5]. Decreased morbidity rates have been reported in patients who underwent distal bowel washout. Others, however, consider distal washout to be associated with a high risk of infectious complications secondary to spillage of intraluminal contents. Presacral drainage is thought to decrease pelvic sepsis rates. There is no proof, however, that presacral drainage improves outcome. This procedure requires an additional incision with dissection of an uninvaded space and special positioning in the operating room. Colonic diversion was performed in both our patients. Distal rectal washout was performed in one patient, and presacral drainage in the other. The latter patient had a prolonged hospital stay secondary to a pararectal collection. Although our experience with these types of injuries is limited, we believe colonic diversion without primary rectal repair, supplemented by distal rectal washout, is the correct approach to this type of penetrating rectal trauma.

In conclusion, we report our experience with two victims of a suicide bombing attack who suffered penetrating rectal trauma from high mass shrapnel in addition to the multiple injuries usually encountered in these patients. We emphasize that the diagnostic approach to these patients should be similar to that in patients suffering isolated missile trauma. The "dramatic" situation in which these victims were injured, together with the multiplicity of florid limb injuries, should not dictate a different diagnostic or therapeutic approach.

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