



## **Case of a 5-Year-Old Foreign National Who Sustained Penetrating Abdominal Trauma**

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## ***Introduction***

An internal medicine physician, two Special Operations Combat Medics (SOCMs), and one radiology technician requested telemedicine guidance about a pediatric patient with delayed presentation of penetrating trauma. This Special Operations Resuscitation Team (SORT) was deployed in Africa Area of Responsibility (AOR). The closest non-US surgical support was a nonsurgeon willing to perform operations who was 20km away or a partner-force surgeon in neighboring country who was 2 hours by fixed-wing flight. At the time of presentation, evacuation was not considered an available option despite multiple attempts.

## ***Case Report***

A male, 5-year-old foreign national was brought to the Special Operations Resuscitation Team (SORT) team by a partner force 1 day after falling on a small 5cm knife. The knife penetrated the ninth intercostal space on the left. His mother had removed the knife before bringing the boy to a local military hospital. There was minimal bleeding reported at the wound site. On presentation to the healthcare facility (which consisted of several tents with no running water, limited power supply, and limited pharmacy), the patient's vital signs were notable for a heart rate of 120 bpm and respiratory rate of 30/min. The patient was afebrile and normotensive, with oxygen saturation of 100% on room air. Physical examination revealed a slightly distended abdomen with pain around the wound site and absent bowel sounds. Pulmonary examination was unremarkable. A focused assessment with sonography in trauma (FAST) examination, performed by one of the SOCMs, revealed a pericardial effusion and chest radiography was concerning for pneumopericardium as well as pneumoperitoneum versus left diaphragmatic rupture with bowel in the left thoracic cavity. The initial request for evacuation for definitive surgical intervention was denied. Medical management over the next several days included antibiotic therapy with metronidazole, ampicillin, and ciprofloxacin, as well as intravenous (IV) fluids; however, the patient's clinical status continued to deteriorate over the next few days: he developed fever, tachypnea, and altered mental status. Abdominal examination continued to be notable for absent bowel sounds and the abdomen developed tenderness to palpation. Pain was controlled with IV morphine. Efforts for medical evacuation to a facility with surgical capabilities were denied until hospital day 3.

## ***Clinical Questions***

- Are there additional recommendations for medical management of penetrating trauma to the abdomen/ thoracic cavity in a pediatric patient?
- In particular, the SORT team was considering improvised drain placement. Request for information regarding considerations guidance for placement and management from surgical specialty or pediatric specialty.

## ***Consultation(s)***

Local: None; a pediatric surgeon was deployed to the same AOR but was only accessible by military evacuation. Telemedical: to the Virtual Critical Care Consultation (VC3) Service.

- Initiated with e-mail to the VC3 Service e-mail, a group distribution list.
- Followed up by telephone within 10 minutes to oncall VC3 intensivist.
- VC3 medical intensivist answered call on first contact. Within the next 30 minutes, contact was established with the San Antonio Military Medical Center pediatric intensivist on call.
- Case discussed with pediatric surgeon on call as well as pediatric infectious disease consultant for further expertise and recommendations.
- Use of the VC3 e-mail for initial notification also allowed for contact with an additional consultant deployed to a facility in the same AOR who was able to provide further expertise and recommendations in the same time zone.

## ***Consultation Recommendations***

- General guidelines regarding fluid resuscitation and monitoring
- Recommended against drain placement.
- Agreed with antibiotic therapy, given limited options in austere environment.
- Pediatric intensivist gave advice regarding pediatric specific resuscitation, including vasopressor selection; tendency for children to develop "cold shock" state induced by limited cardiovascular and neurohumoral reserves that requires vasopressor therapy usually epinephrine; and that the provider should feel comfortable

tolerating tachypnea without evidence of accessory muscle use or retractions in the pediatric population.

- Case discussed with pediatric surgeon to develop surgical plan, and with specialist in pediatric infectious disease for any further antibiotic recommendations. Recommendation made against drain placement and to prioritize evacuation to surgical capability. Current antibiotic selection was appropriate as a temporizing intervention.
- A physician deployed in the same AOR attempted to coordinate with US surgeon from his team; however, coordination with a nongovernmental organization (NGO) enabled transfer to a civilian hospital.

#### Follow-up

The patient was medically managed for 3 days at the original location on the current antibiotic regimen with the plan to broaden antibiotic coverage by replacing ampicillin with ertapenem if the patient further decompensated. On hospital day 3, coordination with an NGO facilitated patient transfer to a healthcare facility with surgical capability. Upon last report, the patient was doing well after emergent thoracotomy for hemothorax and was later discharged home.

#### **Teaching Points**

##### Penetrating Abdominal Trauma

- Management of penetrating injury to the abdomen depends on if the wound has penetrated the fascia, the wound projectile, the zone of the abdomen injured, and the presence of any blast/cavitary effect. Wounds that penetrate the fascia often require surgical management and should be treated with antibiotics until surgical consultation has been obtained. In the setting of low-velocity projectiles or stab wounds, the location of abdominal penetration may suggest injury to underlying structures, whereas high-velocity projectiles (e.g., gunshot wound or fragmentation from blasts) may travel great distances inside the body and the location of penetration does not predict ultimate injury pattern. In a resource-limited environment, a plain radiograph can provide basic information (e.g., presence of free air, diaphragmatic injury, pneumothorax, fragment projectile). If these are found, surgery is most likely necessary.
- Ultrasound can also be very informative anatomically and may help explain physiologic changes (as in this patient). A positive FAST examination suggests the need for emergent surgery if it is performed before resuscitation. Delayed FAST examinations, as in this patient, can be misleading because they may result from inflammatory effects of the injury or from fluid resuscitation. Physical examination that demonstrates signs of peritonitis (discussed below) indicates a probable injury to a hollow viscus that requires surgical repair.
- Concern for stomach or intestinal injury (based on clinical signs) warrants IV antibiotics, which should be continued through definitive surgical care.
- A nasogastric tube can be therapeutic if there is a gastric or intestinal injury, and can be diagnostic if there is a diaphragmatic injury and the tube is seen diverging into the chest on radiograph. Gastric decompression also helps prevent aspiration.

Blind drain placement was considered in this case, but it is not a substitute for surgical management and could potentially be harmful. Although image-guided drain placement via ultrasound for a bowel injury has the potential to control peritoneal sepsis, it will likely result in an enterocutaneous fistula, and is not recommended. All surgical options should be explored and exhausted before such an approach could be considered, and only with expert consultation from a surgeon. “Watchful waiting” (i.e., patiently monitoring the patient without procedural intervention) is an acceptable approach until or unless a patient develops signs of peritonitis on physical examination. These include rigid abdomen with distention, severe pain, fever, and progressive tachycardia. The primary therapy for peritonitis is surgery

#### **Lessons Learned**

- This was a quick and robust response to a complicated clinical scenario in a remote area with a multidisciplinary team of providers to assist with management.
- All parties made contact with the provider in-country within 1-2 hours after initial contact.
- Use of initial e-mail with images of the patient provided complete and concise information regarding the case, which was able to be forwarded to various specialists to assist in management plan.
- There is continued difficulty regarding availability of secret methods of communication for providers who are on call for VC3.

Providing a list of potential subspecialty physicians on call for this consult service could reduce delays in consultative care for patients downrange.

### **References**

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