REVISED CASE REPORT

# Abdominal decompression with Bogota bag in a trauma patient: A case report

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**Abstract:**

**Abdominal Compartment Syndrome (ACS) is a feared complication that can lead to severe consequences like organ failure, can ultimately be fatal if not managed appropriately. The objective of this case report is to highlight a successful preventative measure used to avoid such complications.**

**A 21-year-old patient severely injured in an industrial accident sustained multiple serious and possibly fatal injuries. The most severe was a large wound across the abdomen, exposing the peritoneum and viscera. A life saving damage control surgery was performed through midline Exploratory Laparotomy to achieve hemostasis of major liver trauma with perihepatic packing. Temporary closure with Bogota bag was done to prevent intra-abdominal compartment syndrome and remove the packs in the second look operation.**

**Proper techniques are very crucial in the management of abdominal compartment syndrome. Therefore, temporary abdominal closure with the use of a Bogota bag is a relatively safe and effective way of managing such a serious case.**

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**Introduction**:

Abdominal compartment syndrome (ACS) is defined as a "sustained intra-abdominal pressure > 20 mmHg that is associated with organ dysfunction".[1]

Abdominal compartment syndrome is a feared complication that can lead to severe consequences like organ failure, can ultimately be fatal if not managed appropriately and has a high risk of mortality. Organs begin to fail and collapse under pressure when an increased compression occurs in an already tight space. Careful and deliberate attention should be given to prevent, treat and manage this critical condition.[2] Mainstays of management of abdominal compartment syndrome consist of supportive care, and when needed, Abdominal Decompression with its various methods.[1] Surgeons who decide to take precautionary measures in most laparotomy procedures would usually adopt temporary abdominal closure techniques to postpone definitive closure and, in turn, prevent major complications. Many techniques are currently being used for this purpose, including absorbable mesh, vacuum-assisted closure, negative pressure wound therapy and Silo techniques, including the Bogota bag.[3] The method of using a Bogota bag appears to be safe, readily available and effective in the prevention and treatment of abdominal compartment syndrome (ACS).[4] The case report of a young male patient is presented who had blunt and penetrating abdominal trauma causing evisceration was managed initially by the Bogota bag.

**Figure 1: Condition of the patient on arrival in ED SKGH**

**Figure 2: After the first Exploratory Laparotomy in ED SKGH**

**Case Review**:

A 21-year-old Asian male presented to the Emergency Department (ED) of Sheikh Khalifa General Hospital (SKGH), Umm Al Quwain, UAE, on the 26th of February 2020, following a work related accident at an industrial site. A steel drum with a paint chemical exploded from the heat, and the sheer pressure caused the lid to propel like a missile and hit the patient in the abdomen. He sustained penetrating and blunt abdominal trauma along with a crush injury to the left forearm. On inspection, there was a large gaping wound in the anterior abdominal wall with abdominal evisceration. Fig. 1.

The patient was picked up from the industrial site by the national ambulance. Initial resuscitative measures were started in the ambulance and upon his arrival in emergency department, SKGH, Code Blue Trauma was announced. After successful resuscitation, he was transferred from the emergency department directly to the Main Operating Theatre.

Midline Exploratory Laparotomy was performed under General Anesthesia. Massive Transfusion Protocol (MTP) was initiated for massive hemoperitoneum. After suction and irrigation, a splenectomy was carried out for a shattered spleen. Perihepatic packing was done for uncontrollable bleeding from multiple liver lacerations. Repair of multiple small bowel perforations and serosal injury to the sigmoid colon was carried out. Two drains were placed, the abdominal wall was loosely approximated in the middle, and the remaining wound was left open and covered with Bogota bag and dressings. Fig. 2.

The Vascular Surgeon proceeded with a vein graft for repair of the Radial Artery in the left forearm. The patient received a total of 14 Packed Red Blood Cells (PRBC).

A second Laparotomy was done on the 29th of February 2020, where the liver packs were removed, and the Bogota Bag was replaced. Fig.3.

On the 5th of March 2020, a greenish fluid was found leaking under the plastic Bogota Bag and bowel perforation was suspected. He was taken to the OT for a third Exploratory Laparotomy, where a perforation was detected at the distal ileal loop. 10cm of the ileal loop was resected and an end ileostomy was performed. After further bowel exploration & peritoneal irrigation, the closure of the abdomen was done with a sterile plastic bag.

**Figure 3: Condition of the patient after the second operation: Application of Bogota bag to cover the viscera.**

**Figure 4: Abdominal wall covered with granulation tissue and skin grafts**

Initial post-operative management was in the Intensive Care Unit (ICU), where the patient regained consciousness three days after the third Laparotomy. Feeding was started with a nasogastric tube, and the patient was finally extubated a week later and the I.V central line was removed. Once the patient was stable enough, Vacuum-Assisted Closure (VAC) dressing was applied over the Bogota bag to the open abdominal wound on 12th of March 2020. Finally, he was shifted to the Close Monitoring Bed (CMB) in the male surgical ward and two days later, he was started on a regulardiet.

On the 24th of March 2020, the patient developed a spike of fever that warranted a fourth Exploratory Laparotomy. Purulent discharge along the open gaping abdominal wounds was drained & thoroug hirrig ation was carried out. The Bogota Bag was removed, and the gaping abdominal wall edges brought closer by VAC were now loosely approximated. On 30th March 2020, excision of the necrotic abdominal wall edges was done and at the same time, skin grafts were applied on the left forearm wound. VAC dressing was reapplied to the anterior abdominal gaping wound.

By the middle of April 2020, granulation had started to cover the abdominal wound. The patient was on his way to recovery with normal oral intake. Partial-thickness skingrafts were placed over the granulating anterior abdominal wounds on 20th April 2020. On change of dressing after five days, there was an 80% up take of skingrafts. By mid-May 2020, the wounds on the anterior abdominal wall were healing rapidly due to regular wound dressings. Ileostomy was functioning satisfactorily. The patient had adequate or alin take and was finally able to walk with support. By mid-June 2020, there were only a few remaining patches of granulation tissue. However, the mid-portion of the abdomen was devoid of a muscle layer, and the loops of the intestines were only covered with granulation tissue and skin grafts. Fig.4.

Due to the COVID-19 pandemic, it was not safe for the patient to prolong his hospital stay. His discharge was planned, and he flew back to his home country on the 7th of June, 2020. He was given a Medical Report explaining that he will eventually develop a large midline incisional hernia. Closure of ileostomy and repair of incisional hernia was advised after a gap of six months to one year.

**Discussion**:

Abdominal compartment syndrome is a condition with detrimental effects. It may be under recognized due to its propensity of affecting pa-

tients who are already severely ill and whose organ damage may have been in accurately attributed to the development of the illness they were being treated for primarily. Notably extreme fluid shifts pose a significant threat and potentially unavoidable consequences to severely ill patients. Therefore, careful and calculated approaches should be taken in the observation and treatment of such cases with regards to high clinical suspicion. Their care should include protocolized monitoring and careful management.[1,5]

According to Newman, Dayal and Dominique (2020), abdominal compartment syndrome is categorized in to two distinct subgroups; primary and secondary abdominal compartment syndrome.

Primary abdominal compartment syndrome can be caused by abdominal trauma, either blunt or penetrating. It can also be the outcome of a myriad of abdominal afflictions including abdominal aortic aneurysm (AAA) rupture, retroperitoneal hematoma, and intestinal obstruction. Whereas secondary abdominal compartment syndrome can be the result of chronic conditions affecting intra-abdominal pressure causing it to reach higher levels, including pregnancy, obesity peritoneal dialysis, cirrhosis, and even intra-abdominal malignancies. Other causes involved in the increase of abdominal

Estimates of the incidence of ACS can vary significantly in most evaluation studies, especially ones that have been performed on trauma patients. The most extensive study (n=706) reported a 1% incidence of abdominal compartment syndrome. In contrast, two smaller observational studies (n=128 and n=188) reported an incidence of 9 to 14% of abdominal compartment syndrome.[2,6]

The largest study encompasses a broader sample population, enrolling all patients who were admitted to the ICU. However, the smaller studies included patients with significant chest and abdominal trauma (multiple abdominal injuries, flail chest, considerable vascular injury, complicated pelvic and multiple long bone fractures), either age ≥65 years or the need for transfusion of ≥6 units of packed red blood, and a nearly arterial based eficit of ≥ 6mEq/L.[2] Therefore, data from the previously mentioned studies, and the different enrollment criteria have demonstrated that the incidence of abdominal compartment syndrome is higher among the most critical cases, and patients with severe illnesses.[6]

ICU patients are particularly at risk for developing abdominal compartment syndrome. This issue has been considered by recent work conducted on patients admitted to the ICU. The study showed that 50% of ICU patients were found to have IAH, and from that percentage, 8% were at risk of developing abdominal compartment syndrome.[5] Furthermore, such findings were also commonly seen in ventilated patients. An observational study done by Blaser et al, (2019) on ICU patients revealed that IAH or ACS are prevalent in mechanically ventilated patients.[6]

Several medical conditions affect abdominal wall mechanics. Recent reports have identified disruptions caused by certain conditions that ultimately lead to the development of abdominal compartment syndrome. Such disruptive conditions include those that decrease abdominal compliance, and increase intra- abdominal and luminal contents that cause capillary leaks, which in turn increases abdominal wall pressure.[1]

Other risk factors include trauma cases that require aggressive fluid resuscitation, severe burns (>30% of total body surface area), cases of liver transplant (increased risk of abdominal compartment syndrome by 32%) and massive ascites or intra-peritoneal bleed, retroperitoneal conditions like a ruptured Abdominal Aortic Aneurysm, bleeding pelvic fracture or pancreatitis, medical conditions like sepsis that require massive fluid resuscitation and post-surgical patients who received large-volume resuscitation particularly with crystalloid.[5] Therefore, physicians need to pay careful attention to the amount of fluid being administered to critically ill patients who display early signs and symptoms of

abdominal compartment syndrome, and adjustments in fluid management may be warranted.

Abdominal compartment syndrome is more likely diagnosed in an ICU setting instead of an emergency department because it is characteristically only seen in critically ill patients.

Hence, clinical suspicion for abdominal compartment syndrome (ACS) should be high in patients who recently underwent extensive abdominal surgery. Nonetheless, abdominal compartment syndrome should also be suspected in patients presenting with penetrating abdominal trauma from an emergency setting. They may present with vague symptoms such as abdominal pain and distention. However, these findings are neither sensitive nor specific.

On a similar note, a greater challenge arises when trying to identify signs of abdominal compartment syndrome in the ICU setting. Severely ill patients suffer from multiple ailments, and patients with abdominal compartment syndrome are difficult to diagnose due to the wide array of condition seen in ICU patients, including organ failure not limited to the abdomen. Therefore, distinguishing those ailments from findings relating to abdominal compartment syndrome is often difficult.[1]

A definitive diagnosis of abdominal compartment syndrome requires measurement of the intra-abdominal pressure. Indirect measurement techniques can be used to measure intra-abdominal pressure. Techniques involving the use of catheters inserted in different areas including intragastric, intravesical, intracolonic, or in the inferior vena cava.

The standard method to screen for IAH and abdominal compartment syndrome (ACS) is measurement of intravesical (bladder) pressure.[2,6] This approach is not only simple and minimally invasive, but also accurate owing to the fact that additional pressure from the bladder's own musculature is obviated. Diagnostic radiology exams and other imaging procedures are un-helpful in the diagnosis of abdominal compartment syndrome. In recent years, newer techniques have emerged for the management of abdominal compartment syndrome, and one of the most widely used is temporary abdominal wall closure.[1-3]

Management of abdominal compartment syndrome consists of supportive care and, when needed, abdominal decompression. Supportive measures are taken if patients are not yet indicated for surgical decompression. These measures include decreasing intra-abdominal volume by avoiding positive fluid balance, improving abdominal wall compliance by pain control, sedation, and mechanical ventilation.[2,7] Proper positioning is also very dire in cases suspected of developing abdominal compartment syndrome. Patients should lie supine with head elevated <20 degrees. Pain control and sedation also increase abdominal wall compliance along with pharmacologic paralysis to relax the abdominal wall. If a patient has IAH, trying to decrease fluid volume can decrease the risk of developing abdominal compartment syndrome.[1] Most surgeons go for the primary treatment, which is surgical decompression, then maintain an open abdomen using Temporary Abdominal Wall Closure. The main goal of temporary closure is to control fluid loss and to minimize loss of domain.[3,8]

Many techniques and devices are used in this procedure, like patches (Wittman, PTFE), VAC dressing, Barker's VAC and the AB Thera sponge- based technique.[9]

The technique used to manage our patient is the Silo technique, which involves suturing a large, sterilized translucent bag (Bogota bag) to the abdominal fascia orskin.

Even though this technique can be seen as time-consuming, and fluid losses might be challenging to control, it does have its advantages, seeing that these bags are readily available and easily accessible as a simple plastic bag (intravenous, dialysate, irrigation bag), low cost, and more importantly, it allows visual inspection of the abdominal viscera. Organ dysfunction may significantly improve with surgical abdominal de-

compression due to organ dysfunction being a common complication of compression.

Control of intra-abdominal pressure helps in the prevention of serious complications, especially in severely ill patients who are dependent on mechanical ventilation or renal dialysis. Further support is given by Newman, Dayal and Dominique (2020), that more generally asserts that by relieving compression of the inferior vena cava and circulatory system, patient outcomes can be drastically improved by enhancing cardiac output and successfully ceasing vasopressor support. These events may, in turn, lead to the reversal of acute kidney injury and decreased compression of the ureters and renal arteries. More significantly, as a result of decreasing the tension from the abdomen, diaphragmatic excursion is increased, leading to improved ventilation and declined peak airway pressures.[1]

The necessity of mechanical ventilation, dialysis and extended hospital stays is commonly seen in abdominal compartment syndrome patients. Therefore, if left untreated, abdominal compartment syndrome can be associated with high mortality rates, and the consequences can be fatal.[1]

**Conclusion**:
In conclusion, temporary abdominal closure with the use of a Bogota bag is a relatively safe and effective way of managing abdominal compartment syndrome. Suitable techniques are very crucial in the decision-making process while handling such a case, and going through with the surgical decompression route proves to be definitive, and with proper surgical skills and further intensive care, we can significantly decrease the risk of the myriad of sequelae from developing.

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**Role and contribution of authors**:
Ahmed Albani, collected the data, references and did the initial write up.

Azam Yusuf, critically went through the article and made useful chnages.

Maryam Al Ali, collected the data, completed the literature search and composed the first and final draft of the manuscript.

Taher Helmy, collected the data, references and helped in discussion writing.

Raed Naji, collected the data did the interpretation of data, and helped in introduction writing.

Hessa Abbas, collected the data, references and helpd in discussion and result writing.

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