



Case of the Month

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"A Bad Egg"

ABSTRACT

Gastroenteritis remains one of the most common patient presentations in Emergency Departments all across the globe. As such, ER Physicians are more than accustomed to the grossly predictable nature of history, presentation and examination in such patients. More often than not, an identifiable trigger (e.g. ingestion of food from an otherwise unfrequented restaurant) and a reliable course of events (e.g. symptoms of fever, abdominal pain and diarrhea soon after eating the food) gives us most of the information we need to guide our treatment plan. However, the Emergency Department is famously host to a diversity of unexpected phenomena and sometimes even the most straight-forward scenarios can end up hurtling towards disaster. This case report follows a case of a 19 year old Indian male who presented to the Zayed Military Hospital, Abu Dhabi Emergency Department with a history of fever, abdominal pain, vomiting and diarrhea after ingestion of eggs and beans.

CASE PRESENTATION

A 19-year-old male from India presented to the Emergency Department with a history of vomiting, diarrhea, fever, diaphoresis, abdominal pain and poor oral intake since 15 days roughly after eating some eggs and beans. He had no known co-morbidities and worked as the chef on a ship that travelled between different countries and had most recently been to Yemen. The past medical history was insignificant save for one recalled similar episode many years ago with no reported complications. He initially presented to another clinic for his complaints where he was found to have high Liver Function enzymes. Suspecting a possible hepatitis infection, he was given IV Ceftriaxone 2g, Metronidazole 500mg and fluids in the clinic before being referred and brought directly to Zayed Military Hospital, Abu Dhabi for further management.

EXAMINATION

Upon presentation to ZMH ED, the patient was found to be febrile, slightly anxious, pale but not visibly jaundiced, with the following findings on examination:

VITAL SIGNS

Temp: 40.1°C
HR: 100
RR: 24
BP: 140/90
spO₂: 95%

PHYSICAL EXAMINATION

Neck: No neck stiffness
Chest: Bilateral good air entry. No added sounds
Abdomen: Soft, Positive bowel sounds, right iliac fossa + epigastric tenderness, no organomegaly
Cardiovascular: Normal S1 + S2. No murmurs
Extremities: No lower limb edema

ECG: Mild tachycardia, otherwise no ischemic changes or other abnormalities noted

Initial ABG: pH 7.34 pO₂ 81 pCO₂ 38 HCO₃⁻ 20.5 Lactate 1.0
 K 2.9 Na 124 Glu 79

While in the ED, he was started on IV Ciprofloxacin and investigations were ordered while Internal Medicine prepared the patient for admission and further management.

A preliminary chest X-ray showed:

Bilateral Congested Bronchio-vascular markings

Cardiac shadow within limits

No Pneumothorax or effusion

Less than an hour after his arrival, the patient began complaining of shortness of breath. The patient became visibly tachypneic, tachycardic and spO₂ was seen to drop to low 70s over the course of minutes. A non-rebreather mask was applied and another ABG obtained for the patient.

Second ABG: pH 7.26 pO₂ 56 pCO₂ 45 HCO₃⁻ 20.2 Lactate 1.1
 K 2.9 Na 124 Glu 80

The patient did not improve his oxygenation status and eventually non-invasive ventilation (BiPAP) was initiated. However, spO₂ still failed to rise above 77% even when IPAP and EPAP were increased to 20 and 10 respectively.

Given the patient's deteriorating status and difficulty maintaining adequate oxygenation with his current airway status, the decision was made to advance to Delayed Sequence Intubation (DSI). Ketamine allowed the Physician to adequately pre-oxygenate the patient and obtain a sufficient rise of spO₂ from 77% to 100% for several minutes before a definitive airway was established with an Endotracheal Intubation.

The patient was eventually shifted to the Critical Care Unit. Investigations revealed the findings listed below.

INVESTIGATIONS

BLOOD PROFILE

WBC	4.55 x 10 ⁹ per liter (L)
HGB	13.2 g/dl
PLT	18
PT 22	INR 1.91
Glucose	PTT 96.6
	4.56 mmol/L

METABOLIC PANEL

Creatinine	147 µmol/L
BUN	5.59 mmol/L
Total Bilirubin	18.68 umol/L
Direct Bilirubin	15 umol/L
AST	1389 U/L
ALT	388 U/L
Alk Phos	78 IU/L
Na	128 mEq/L
K	3.1 mEq/L
Ca	1.71 mmol/L
Amylase	331 U/L
Lipase	1088 U/L

SPECIFIC MARKERS

Fibrinogen	148 mg/dL
D-Dimer	10.33 µg/mL
Creatinine Kinase	9,101 U/L
LDH	2780 U/L
CRP	112 mg/L
Myoglobin	358 ng/mL
Procalcitonin	8.29 ng/mL

MICROBIOLOGY

Malaria	NEGATIVE
Urine Culture	No Bacterial Growth
MRSA	Not Detected
Malaria	Negative
Stool	No C.Diff, ova, cyst or parasites
Dengue PCR	Negative
PCR for Salmonella and Campylobacter	Positive

The above list of investigations revealed their results over the course of the patient's stay and displayed simultaneous insults to various body systems, with features suggestive of **Multi-Organ Dysfunction Syndrome (MODS)**.

INTERVENTIONS

For each of the following constellation of symptoms, measures were taken as follows:

1. Fever + Diarrhea. Sepsis with Multiorgan Dysfunction Syndrome (MODS):

Empiric Therapy: IV Ciprofloxacin 400mg BID, IV Metronidazole 500mg TID
Added Tazocin 2.25g IV later during inpatient stay

2. Acute Kidney Injury: Likely secondary to Dehydration and Gastroenteritis. Aggressive IV Hydration. Central Line Inserted

3. Tachycardia, Tachypnea, Desaturation + High D-Dimer: CT Chest done to rule out PE: No evidence of pulmonary thromboembolism.

Enoxaparin 60mg subcutaneous given

4. CT Abdomen with contrast (to rule out intestinal perforation and abscess):

Diffuse inflammatory change, colitis. No free intra-abdominal gas is identified to suggest bowel perforation

5. Thrombocytopenia/Coagulopathy: Platelet transfusions

Peripheral smear- Moderate normocytic, normochromic anemia

-Severe thrombocytopenia with no aggregation or clumping

DISCUSSION

This patient is an example of Multi-Organ Dysfunction Syndrome (MODS) secondary to sepsis-induced Disseminated Intravascular Coagulation (DIC), in this case brought on by a food-borne infection of *Salmonella* species. Several learning points exist within the sequence of events surrounding this patient's presentation and management:

Why DSI?

Standard Rapid Sequence Intubation (RSI) is usually employed in cases where a definitive airway is needed. However, the patient in this scenario had difficulty maintaining an adequate oxygenation status. This presents us with a significant problem- failure to adequately pre-oxygenate this patient will allow the RSI-induced respiratory paralysis to cascade into an exacerbation of his hypoxia and a potential 'crash'. Situations such as this need to place emphasis on pre-oxygenation methods and, when non-invasive ventilation failed to produce the oxygenation we desired in this case, Delayed Sequence Intubation is indicated.¹

One way to look at DSI is to consider it as a procedural sedation where the procedure in question is pre-oxygenation.² Ketamine is considered the ideal induction agent for DSI since it has the unique ability to sedate the patient while preserving airway reflexes and respiratory drive, thus allowing the airway to become more amenable to ventilation and, therefore, oxygenation. A proposed algorithm for the procedure is outlined in Figure 1.

What IS Multi-Organ Dysfunction Syndrome (MODS) and how should we manage it?

Multi-Organ Dysfunction Syndrome is essentially a process of progressive physiologic derangement and dysfunction in two or more organ systems as a consequence of pathologic interaction between host defenses, the inflammasome, and the coagulation system.³ A potentially fatal cascade of events, MODS can be triggered by a variety of different causes, as outlined in Figure 2.

Sepsis
Multiple trauma
Burns
Pancreatitis
Gastric aspiration
Massive hemorrhage
Massive transfusion
Ischemia-reperfusion
Ischemic necrosis
Microvascular thrombosis
Interleukin-2 therapy ("cytokine-release syndrome")
Salicylate intoxication
Multiple sequential physiologic insults

Figure 2- Causes of Multi-Organ Dysfunction Syndrome (MODS)

The approach to a patient with MODS is essentially the same as that with septic shock, with emphasis being placed on three major goals for patient management⁴:

1. To *resuscitate* the patient, using measures to correct hypoxia, hypotension and impaired tissue oxygenation
2. To *identify* the source of infection and treat it with antimicrobial therapy, surgery, or both
3. To *maintain* adequate organ system perfusion/function and to interrupt the pathogenesis of multiple organ dysfunction syndrome (MODS)

Can all Salmonella be this dangerous?

Salmonella, more frequently non-typhoid Salmonella, can sometimes invade into the blood stream and become a potential cause of sepsis in patients. Studies on Salmonellosis revealed a relatively uncommon (5-10%) isolation of non-typhi Salmonella in blood^{5,6}. However, once it has invaded the bloodstream, Salmonella, like most other bacteria, carries the risk of sepsis as a natural progression of any infection that is left unchecked or improperly controlled (immuno-compromise increasing the risk of septicemia to 35%). Ciprofloxacin is currently considered the treatment of choice to specifically counter the effects of Salmonellosis.⁵

CONCLUSION

In our patient, the sepsis brought on by the hematogenous spread of Salmonella infection led to a dysregulation of the coagulation cascade, culminating in Disseminated Intravascular Coagulation (DIC) along with diffuse inflammatory changes that resulted in a clinical picture of Multi-Organ Dysfunction Syndrome (MODS). It is important to note that, despite the severity of illness, resuscitation remains the same with initial focus on airway and ventilation. The Delayed Sequence Intubation (DSI) is an extremely useful tool to employ for patients in whom RSI could exacerbate an already hypoxic state, as in this case.

Overall, the patient responded well, was admitted to the ICU where he was later extubated, stabilized and eventually discharged with full recovery.

Delayed Sequence Intubation (DSI) Progression

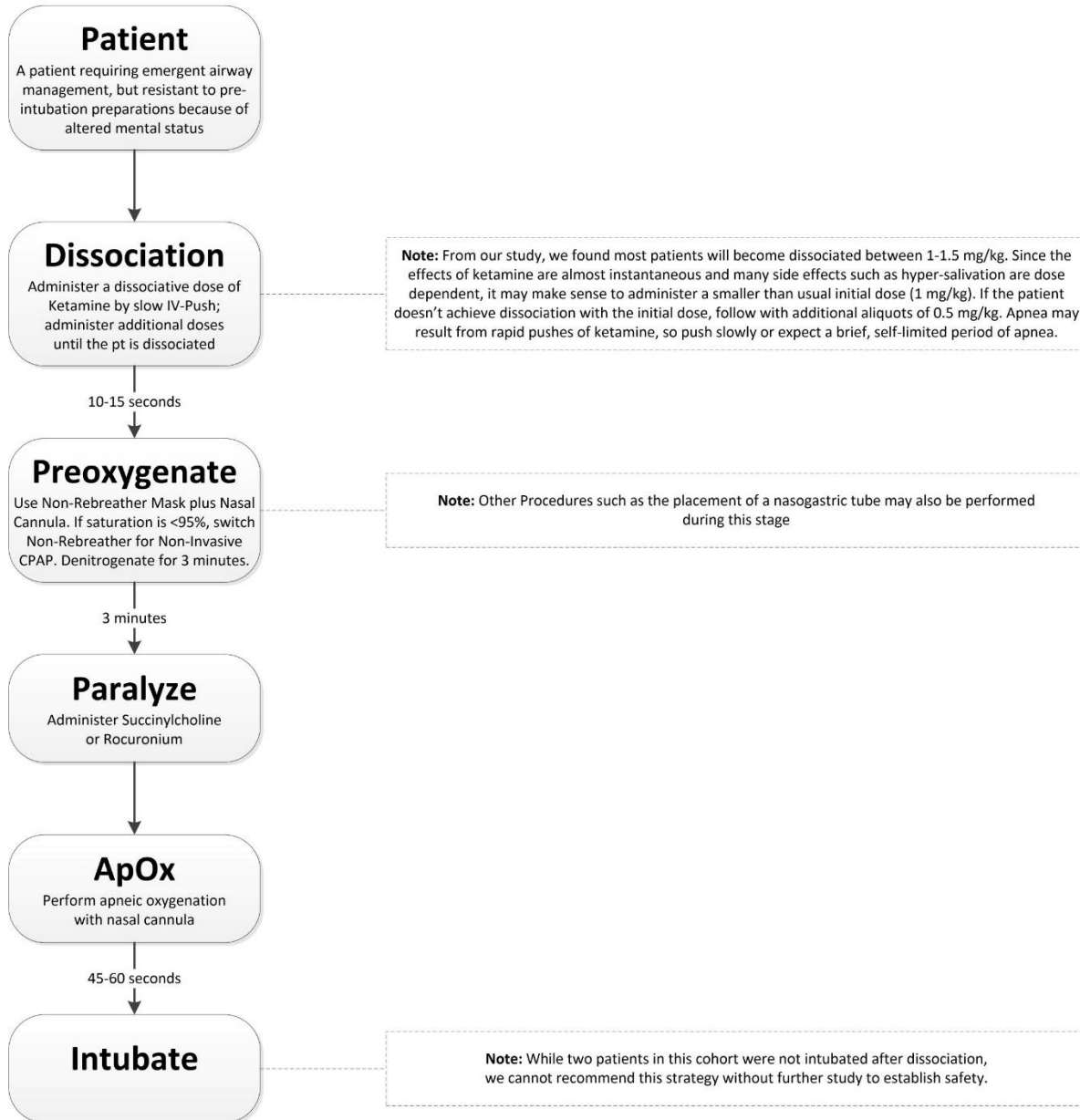


Figure 1- Delayed Sequence Intubation (DSI) Algorithm

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