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THE EXCHANGE

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A Knowledge Sharing Initiative by Medanta

Damage Control Resuscitation: A Practical Approach for Severely Haemorrhagic Patients of Trauma

The concept of Damage Control Approach is a paradigm shift from definitive repair of all injuries to focused haemorrhage control, containing contamination, and deferring definitive repair for a later stage at an appropriate time after initial stabilisation of the physiological parameters. This change has increased survival rate after major trauma to over 50%.

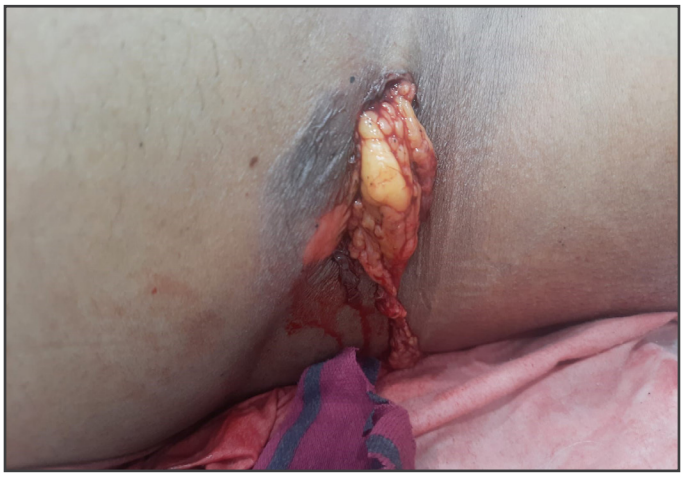
The vicious triad of death in trauma, namely hypothermia, acidosis, and coagulopathy, should be tackled by either initial abbreviated laparotomy or any other damage control procedure, correction of physiological derangements, and finally, definitive repair of all injuries at a later stage. The concept requires a dedicated team effort with careful patient selection to achieve favourable results.

Case Study

A 46-year-old male presented to Medanta - Patna with impalement injury to the abdomen caused by an iron rod while working in an iron factory. The patient was first taken to a local hospital and then referred to Medanta's Emergency department around 11:20PM – 100 minutes after the time of injury.

At the time of presentation, the patient's vital parameters were as follows:

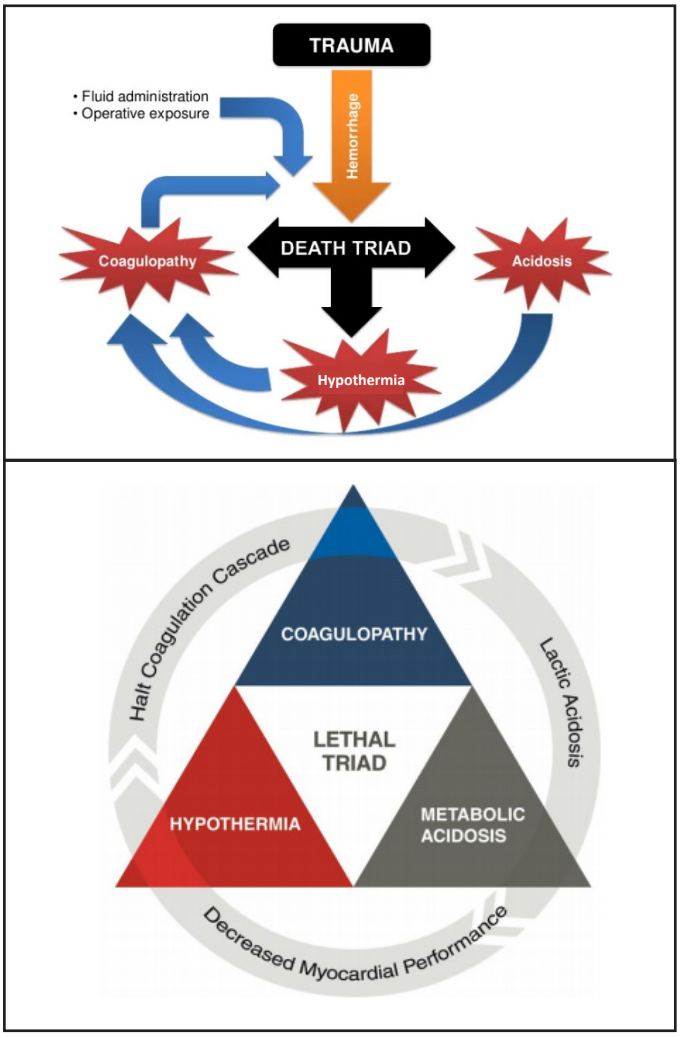
- Airway: Patent.
- Breathing: Spontaneous, respiratory rate (RR) - 24/min, bilateral air entry present, SpO2 - 95% on six litres of oxygen by facemask.
- Circulation: Pulse - 110/min, blood pressure (BP) -76/44 mm of Hg, a soaked dressing was present at the right iliac region, Extended Focused Assessment with Sonography in Trauma (E-FAST) was positive with gross haematuria on Foley's catheterisation.
- Disability: Patient was drowsy, E3V5M6 (GCS 14), all four limbs were moving equally.
- Exposure: A lacerated wound of size 5cmx7cm seen in the right iliac region just above the right anterior superior iliac spine (ASIS) with omentum coming out; hypothermia prevented by blanket and warmer.



Lacerated wound in the right iliac region

The patient was immediately resuscitated with one litre of warm crystalloids and reviewed again. His pulse rate changed to 120/min and systolic BP remained around 70mm of Hg. In view of penetrating wound to abdomen, haematuria, E-FAST positive and non-responsiveness to initial bolus fluid, the patient was marked as "non-responder" and massive transfusion protocol was initiated. The patient was shifted to the operation theatre (OT) for "damage control surgery (DCS)" within half an hour of the patient's arrival.

Midline exploratory laparotomy was done. After opening the peritoneum, blood and blood clots started coming out, so intraperitoneal packing was done. Intra-operative transfusion of blood and blood products (fresh frozen plasma: platelets: red blood cells) was started in the ratio of 1:1:1. The patient was put on high doses of triple inotropes and packs were removed one by one following which blood spurt from the wound in the retroperitoneum. Intra operatively, the systolic BP fell up to 40mm of Hg in spite of ongoing blood transfusion and inotropes. So, retroperitoneum was packed with mops. There was complete tear of the rectus abdominis on the left side with haematoma in the suprapubic region. The intraperitoneal compartment was packed and the abdomen was kept open after giving plastic sheet of urobag over it. Patient was shifted to the intensive care unit (ICU) for resuscitation and physiological restoration.



Lethal triad in trauma

After 12 hours of resuscitation in the ICU, some improvement was seen in the patient's physiological parameters including urine output, tapering of inotropes, stable haemoglobin, lactate level, etc. Hence, after informed consent, the patient was again taken to the OT for re-laparotomy and definitive repair. Under general anaesthesia (GA), the abdomen was explored by removing the packs one by one. The right visceral medial rotation was done and, the aorta and the inferior vena cava (IVC) were exposed to look for any injury. There were a few, small, active bleeders in the lower pelvis and retropubic area, which were secured and ligated. Dome of the urinary bladder was found to be lacerated, which was repaired in two layers. Left femoral artery was also explored because there was haematoma in the lower abdominal wall and groin; the artery was found to be intact. On further inspection, a laceration was found in the distal ileum around one foot proximal to the ileocecal (IC) junction, which was brought out as a loop ileostomy. Haemostasis was secured, and thorough peritoneal lavage was done; all defects in the abdominal wall and muscles were repaired; midline laparotomy was closed after putting two abdominal drains.

The patient was again shifted to the ICU for ongoing resuscitation. Postoperatively on Day 1, the patient was put on mechanical ventilator with pulse - 115/min, BP - 115/67 on NA@4ml/hr and vasso@1ml/hr, SpO2 - 92% on fraction of inspired oxygen (FiO2) - 30%, urine output - 100ml/hr and clear, no haematuria with minimal abdominal drain output, and healthy stoma, but not functional. In view of these parameters he was continued on supportive treatment.

The patient was extubated postoperatively on Day 2. Inotropes were stopped on Day 3 and the patient was started on liquid diet on Day 4 since stoma became functional. He had a few episodes of fever during his ICU stay that were managed with culture-based antibiotics. He was shifted to the ward on Day 5 and discharged on Day 12 in a very stable, ambulating condition.

Discussion

The concept of "damage control" was borrowed from the United States Navy. It represents the capacity of a ship to absorb damage and maintain

mission integrity. In surgery, "damage control" refers to staged strategy for treatment of severe exsanguinating injuries designed to ensure patient survival. To begin with, the concept of DCS was applied to abdominal trauma, but now it is also being extended to other serious and life-threatening extra-abdominal injuries in which performing definitive and prolonged surgeries may end up in loss of the patient's life.

The concept of abdominal packing for uncontrolled haemorrhage is one of the initial damage-control manoeuvres described in 1908 by Pringle – the first to describe the concept of hepatic packing in patients with portal venous haemorrhage. Halsted later encouraged the placement of rubber sheets between the packs and the liver to protect liver parenchyma.

In 1983, Stone introduced the concept of abbreviated laparotomy and intra-abdominal packing for exsanguinating hypothermic and coagulopathic trauma patients. Definitive surgical repairs were accomplished once haemodynamic stability was restored and coagulopathy corrected. This strategy resulted in survival of 11 patients out of 17 who were found to have coagulopathy. Application of these techniques to trauma patients, including major vascular injuries, continued to evolve over the next several years.

Potential lethal links between hypothermia and coagulopathy in trauma victims have also been studied extensively. Hypothermia, acidosis, and coagulopathy are associated with high mortality. DCS is used in patients who would not survive regular surgery because of their deranged physiological state. Sharp and Locicero demonstrated that packing the abdominal cavity to prevent development of acidosis, hypothermia, and coagulopathy can be done safely.

In 1992, Rotondo and Schwab coined the term "damage control" and outlined logistics of performing the three-phased approach. They reported survival rate of 77% in patients with major vascular injury, and two or more visceral injuries. More recebtly, Johnson and Schwab introduced a fourth phase to the existing three, and referred to it as "Damage Control Ground Zero" or DC 0. It represents the earliest phase of damage control in the pre-hospital arena or ED, and focuses on injury pattern recognition and early decision to proceed with damage control. It includes strategies, such as minimising pre-hospital time and abbreviated ED resuscitation that includes intubation, blood transfusion, and rapid access to the OT. Throughout damage control, they also emphasised rewarming as well as restoring red cell and plasma volume. They reported 90% survival in their damage control population, confirming the effectiveness of these strategies. A recent collective review by Shapiro et al. of over 1,000 damage control patients reported an overall survival rate of 50%.

Summary

Damage control surgery is employed in a wide range of abdominal and extra-abdominal emergencies and is an increasingly recognised life-saving tactic in emergency surgery performed on physiologically deranged patients. The concept of DCS is rapid initial control of haemorrhage and contamination with packing and temporary closure, followed by resuscitation in ICU, and subsequent re-exploration and definitive repair once normal physiology has been restored.

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A Case of Pyrexia of Unknown Origin

Pyrexia of unknown origin (PUO) is a syndrome that has long tested the skill of physicians to achieve a diagnosis in affected patients. PUO has the following defining characteristics:

- A temperature greater than 101°F on several occasions
- Illness lasting over three weeks
- Failure to reach a diagnosis despite one week of in-patient investigation

Case Study

A 14-year-old boy from Sikkim presented to Medanta - Gurugram with complaints of fever,

body ache and generalised weakness since one month. He had high-grade fever spiking two to three times in a day, accompanied by rigors. There was documented weight loss of around 3 kgs since the start of his illness. He had consulted various local doctors and received multiple oral antibiotics for the last 10 days before being admitted to a local hospital where his Widal test and scrub typhus IgM results came positive. He received intravenous ceftriaxone and doxycycline for five days, which was changed to meropenem for the following five days. The result of his blood investigation done during this period was:

	20-10-23	26-10-23	30-10-23	03-11-23	6-11-23
Hb	12.8	11.7	11.2	11.4	11.3
TLC	5600	16,500	14,000	17000	14,600
DLC	N66L30E2M2	N80L15E3M2	N84L14	N84L12	N83L14
PC	2.6lac	2.6lac	3.2lac	4lac	4.5lac
ESR	70	22	74	73	68
CRP		127mg/L	86mg/L	94mg/L	
Procal				0.14ng/ml	

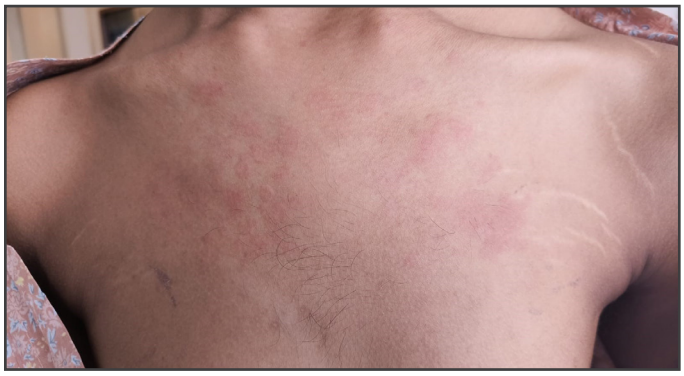
His computed tomography (CT) scan of thorax showed ground-glass opacity in posterior segment of the right upper lobe, probably infective in origin. As fever was still persisting, the family brought the child to Medanta - Gurugram.

At the time of admission, general and systemic examination was within normal limits. Routine blood investigations showed neutrophilic leukocytosis and raised inflammatory markers as shown in below table:

Hb	10.4
TLC	13,350
DLC	N80L16
Platelet count	3.9 lac
ESR	61
CRP	144mg/L
Procalcitonin	0.18
Ferritin	517
Albumin	3.2
Triglycerides	38
LDH	253
PT/APTT	normal
Urine R/M	normal

His blood and urine cultures in addition to Widal test and serological tests for scrub typhus, chikungunya, leptospira and brucella were found to be negative. Viral screening for Epstein-Barr Virus (EBV), Cytomegalovirus (CMV), and HIV were also negative; peripheral blood smear showed no abnormal cells.

On Day 2 of the admission, bronchoscopy and bone marrow examination was done. Bronchoalveolar lavage (BAL) was negative for genexpert, pneumonia polymerase chain reaction (PCR) test showed human rhinovirus and enterovirus, while bone marrow aspiration and biopsy were normal and culture was sterile; 2D Echocardiogram (Echo) was also normal.



Erythematous maculopapular rash over patient's trunk

On Day 3 of the admission, the child developed erythematous maculopapular rash over his trunk. His SARS-CoV-2 (COVID-19) IgG antibody came positive 1799AU/ml (normal<50) on Day 4 of admission. Same day, his ENA profile test showed positive dsDNA (40U/Ml), but antinuclear antibody test (ANA) was negative. Some lab parameters were also repeated. There was slight decrease in CRP (90), ferritin increased further to 757, albumin decreased to 2.9, TLC was 9170, and DLC at N77L16. D-dimer was 1629, NT Pro-BNP was < 20 and RA factor was negative. Complement (C3, C4) levels were normal, direct Coombs test was negative.

Based on the above clinical findings and blood reports, our differentials were multi-system inflammatory syndrome in children (MIS-C), systemic lupus erythematosus (SLE), and systemic onset juvenile idiopathic arthritis (SJIA).

Hence, a rheumatologist's opinion was taken. SLE was ruled out as ANA was negative and other diagnostic criteria were not met. Similarly, MIS-C

was also ruled out as there was no end-organ dysfunction. So, diagnosis of SJIA was considered and the child was started on oral steroids and weekly methotrexate on Day 5 of admission. Patient became afebrile within 24 hours of starting treatment. Blood investigations were repeated four days after starting treatment. It showed decreased CRP and Ferritin, 28.6 and 473 respectively, and the patient was discharged on the same treatment.

Conclusion

Systemic JIA is a rare subtype of juvenile idiopathic arthritis that causes multisystem inflammation. It is very distinctive, but may be difficult to diagnose as arthritis may not be evident early in the course of the disease, and there are currently no specific diagnostic tests for this disorder. Affected children often present with high-grade fever, rashes, elevated white cell counts, anaemia, and elevated acute phase reactants.

Most children are unable to get a correct diagnosis leading to repeated investigations and escalation of antibiotics or poly microbial therapy without evidence. This leads to considerable delay in diagnosis and initiation of specific management. In this case, a high index of suspicion, timely referral and multidisciplinary involvement led to an early diagnosis, leading to early initiation of treatment and better clinical response.

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Spotlight

Foetal Medicine

Safeguarding the Health of Mother and Baby

Foetal medicine or maternal-foetal medicine (MFM) is a subspeciality of obstetrics that focuses on the diagnosis and management of health concerns that a pregnant woman and her foetus may experience before, during or immediately after pregnancy.

Foetal medicine specialists are trained in how to assess and manage high-risk pregnancies, and are skilled in determining the risk and diagnosis of any inherited impairment and defects in the unborn foetus. They provide routine antenatal care to low-risk groups as well in the form of various specialised scans and aneuploidy screening tests to monitor the foetal growth, well-being and to detect the foetus at risk for aneuploidies.

The high-risk pregnancy group includes mothers with medical disorders such as diabetes, hypertension, cardiac disorders, connective tissue disorders (SLE, Sjogrens), thyroid disorders, cancer, chronic illnesses like renal or liver disorders. Women in this group require special antenatal care as they are more prone to develop various foetal, maternal and pregnancy complications, for example, miscarriage, foetal structural abnormalities, intrauterine demise, preterm labour, preeclampsia, prematurity related complications and worsening of maternal existing disease.

The Foetal Medicine Department at Medanta is fully equipped with cutting-edge technologies and state-of-the-art 3D / 4D ultrasound scanning equipment to assess the growth and development of an unborn baby at various stages of pregnancy. This diagnosis also helps in early detection of illnesses and abnormalities, enabling early treatments that keep the mother and child from getting affected. The department offers comprehensive, compassionate and exceptional services, including advanced maternal and foetal care, expert genetic counselling, foetal ultrasound examinations, foetal well-being tests, latest

diagnostic tests, and foetal surgery, including advanced foetal procedures that are only available at a handful of centres in India.

Conditions monitored and treated by the Medanta Foetal Medicine Department:

- High-risk pregnancy
- High-risk aneuploidy screening test result
- Structural abnormality detected in the foetus
- Rh isoimmunised pregnancy where foetus is at risk for foetal anaemia
- Multiple pregnancy
  - High birth order for foetal reduction to reduce foetal and maternal complications
  - Selective reduction if one of the foetus is abnormal
  - Early diagnosis and management of complications especially in monochorionic pregnancies
- Previous baby/pregnancy affected by genetic disorder
- Family history of genetic disorders

Services Offered:

Scan Services

- Viability scan
- NT scan (Level 1 scan)
- Early anomaly scan
- Anomaly scan (Level 2/TIFFA scan)
- Multiple pregnancy scan (Twin/high-birth order)
- Foetal Echo
- Foetal neurosonogram
- High-risk pregnancy scan
- Foetal well-being scan (Growth and Doppler scan)

Screening Services

- Down syndrome screening test
- First trimester combined screening (Dual marker test)
- Quadruple screening test
- Noninvasive prenatal testing (NIPT)
- Preeclampsia screening test
- Thalassaemia screening test

Genetic Test

- Couple carrier screening
- Genetic test on prenatal sample and blood
- Foetal autopsy

Prenatal Diagnostic and Therapeutic Procedures

- Chorionic villous sampling
- Amniocentesis
- Cord blood sampling
- Foetal reduction
- Foetal urine sampling
- Intrauterine blood transfusion
- Shunt procedure
- Radiofrequency ablation for foetal reduction in monochorionic pregnancy
- Foetoscopic laser photocoagulation for twin to twin transfusion syndrome

3D / 4D ultrasound machine

Dr. Geetanjli Behl

Senior Consultant - Foetal Medicine
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Medanta - Gurugram

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Spotlight

Medanta Labs proudly celebrates the opening of 100 diagnostic centre across Delhi, Noida, Gurugram, Lucknow, Indore, Ranchi and Patna. This marks a significant step in our commitment towards bringing reliable and rapid testing services closer to our patients.

Kudos

Welcome Onboard

Dr. Krishna Mohan Sahu

Director - Nephrology and Kidney Transplant Medicine

Medanta - Patna

Nephrologist with expertise in kidney transplantation, preventive and interventional nephrology, critical care nephrology, haemodialysis and peritoneal dialysis in addition to the management of complex kidney diseases.

Dr. Shashi Kumar

Associate Consultant - Urology

Medanta - Patna

Urologist with expertise in endo-urological procedures (PCNL, URSL, Cystolithotripsy, TURP, TURBT, VIU), paediatric urological procedures, AV fistula creation, and renal transplantation, in addition to uro-oncological surgeries including radical nephrectomy, radical cystectomy, ilio-inguinal block dissection and palliative cystectomy with urinary diversion.

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Dr. Davinder Kumar Verma
Associate Consultant - Neurorehabilitation
Medanta - Gurugram

Physiatrist with expertise in neuro-rehabilitation, musculoskeletal rehabilitation, geriatric rehabilitation and pain mannagement.

Dr. Divya Bisht
Associate Consultant - Ophthalmology
Medanta - Gurugram

Ophthalmologist with expertise in medical and surgical glaucoma, glaucoma lasers and cataract surgery.

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*Upcoming