Criticalist Approach to ER

Outline

• Trauma patient
• Hemoabdomen
• Parvo
• Feline urethral obstruction

Recall

• Initial Evaluation
  • Brief history
  • Primary survey
  • Rapid diagnostic tests
• Assessment & Plan
  • Therapeutic plan
  • Diagnostic plan
• Ideal & Minimum

• Formulate DDx list and refine as work thru above
Trauma

• Polytrauma common (>70%)
• Thoracic cavity commonly involved
• Pain consistent
• Shock variable but reversal critical

Trauma - shock

• Physical exam parameters
  • Mentation
  • Mm/crt
  • Heart rate
  • Respiratory rate
  • Dorsal or femoral pulses
  • Peripheral temperature

• Ancillary test parameters
  • Lactate
  • Hypotension

HBC

• 3yr MN Great Dane
• No prior health concerns
• HBC approx. 30min prior to presentation
• Active bleeding since trauma
• No reported LOC
• Ambulatory (3legs) initially
• Progressively weaker and quieter since trauma
HBC

• Primary Survey
  • QAR but aware of surroundings
  • PLRs wnl, no visible facial wounds
  • RR increased but no effort
  • MM light pink, CRT ~ 2 sec
  • Sinus tachycardia 182pm
  • Weak dpp
  • Chest clear
  • Active hemorrhage from distal FL
  • Small superficial abrasions & bruising along thorax & FL

• Initial Assessment
  • Critical – active hemorrhage
  • Compensatory hemorrhagic shock

• Initial Plan
  • Control hemorrhage
  • IV assess
  • Analgesia
  • Crystalloid bolus(s)

Hemorrhagic shock - treatment

• Compressible hemorrhage
  • Compression or ligation
  • Crystalloid boluses
  • 10-20ml/kg q3-5min
  • Voluven bolus
  • 5ml/kg
  • WB or component
  • Refractory cases

• End points
  • Improved perfusion parameters
  • SAP > 90mmHg/MAP > 60mmHg
  • Normal lactate within 6hrs

HBC

• Preliminary Diagnostics
  • PCV 48%, TP 60 g/L
  • BG 7mmol/L, with normal Elytes
  • Lactic acidosis (lactate 5.2 mmol/L)
  • SAP 92 mmHg
  • EKG 146 bpm
  • aFAST
    • 0/4 quadrants for FF, bladder intact and visible GB
  • tFAST
    • No pleural or pericardial effusion
    • No appreciable bilir

• Revised Assessment
  • Responding to therapy – CV stable
  • Hemorrhage controlled (temporarily)

• Revised Plan
  • Primary hemostasis and wound closure
  • IV cephazolin for wound(s)
  • Detailed exam
  • Monitor for delayed internal complications (24hrs)
Traumatic brain injury (TBI)

- 6yrs MI SheppardX
  - No significant prior health concerns
  - Missing 4hrs ago
  - Found on side of road 2hrs prior to presentation
  - Altered and unable to walk since found

TBI

- Primary Survey
  - Altered
  - RR/effort increased but auscultation wnl
  - Visible flail chest – right side
  - MM light pink, CRT < 2 sec.
  - Sinus tachycardia 175bpm
  - Palpable dpp
  - Facial lacerations and ventral abdominal abrasions
  - No visible external hemorrhage

- Neurological Exam
  - Altered but responds to noxious stimuli
  - Non-ambulatory but PP in all 4 limbs
  - No appreciable back/neck pain (mentation)
  - PLRs present bilaterally but decreased
  - Left hyphema & anisocoria (L<R)
  - Menace intact
  - Slight head tilt to right
TBI

• Initial Assessment
  • Critical – HBC and TBI
  • Concurrent thoracic trauma

• Initial Plan
  • O₂ supplementation (mask)
  • IV access
  • Analgesia
  • 30°-incline
  • Avoid jugular compression

  • aFAST
    • Positive 2/4 quadrants (scant)
    • Intact urinary bladder/GB
  • rFAST
    • No pericardial effusion
    • Scant pleural effusion
    • Positive glide sign
    • Early Blines
  • NIPB
    • SAP 96mmHg, MAP 72 mmHg

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TBI

• Revised Assessment
  • Critical – HBC and TBI
  • Flail chest with suspect contusions
  • Scant pleural/peritoneal fluid
  • Suspect hemorrhage

  • Therapy
    • Crystalloid bolus(s) 20ml/kg
    • Judicious
    • Hyperosmolar therapy 7.5% HTS
      • 2.5-4ml/kg IV over 5-10min
    • Titrate analgesia
      • Fentanyl infusion
      • Metacam once stable
    • Soft padded bedding +/- ucath to prevent urine scalding
    • Sedatives
      • Gabapentin +/- diazepam/ace

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TBI Monitoring

• Serial assessment (q1-3hrs)
  • Mentation
  • Brain stem reflexes (eg PLRs)
  • Motor

• Reassess perfusion & analgesia
  • Continuous EKG & intermittent NIBP
  • Serial aFAST/rFAST for ongoing hemorrhage

• Trend RR/effort
  • Titrate O₂ support

• Target end points
  • MAP > 80mmHg
  • PaO₂ > 60 mmHg
  • SpO₂ > 95 %
  • PaCO₂ 40-50 mmHg
Highrise Trauma

- >45% sustained limb fractures
  - Hindlimb (61.5%) > forelimb (38.5%)
  - Thoracic trauma in 33%
    - 20% pneumothorax & 13% contusions
  - Fall > 7+ stories
    - More severe injuries and more thoracic trauma

- 39% sustained limb fractures
- Facial trauma 57%
- Thoracic trauma in 90%
  - 63% pneumothorax & 68% contusions
- Variable presentation
  - Urgent – 37% (shock and thoracic), Non Urgent 30% and Observation 30%

Height and surface affected severity of presenting status and injuries
- < 3 stories more orthopedic extremities
- Higher more spinal injuries
- Refractory cases suspect visceral trauma (e.g. abdominal)

Highrise Cat

- Middle aged FS DSH
- Found on ground near apt complex
- Brought in by good samaritan
Highrise Cat

- Primary Survey
  - Alert but distressed
  - Blood on face
  - Dyspneic with minimal chest wall movement
  - PP pale/ CRT unable to assess
  - Auscultation – dull
  - Femoral pulses weak
  - Visible movement in 3 limbs

- Initial Assessment
  - Critical – dyspneic
  - Painful
  - Likely concurrent injuries

- Initial Plan
  - O2 supplementation
  - Sedation/Analgesia
  - IV assess
  - Thoracocentesis

Thoracocentesis

- Local block
  - Lidocaine 2mg/kg down to pleura
- Stertal
  - 7th-8th ICS upper 3rd
- Lateral
  - 7-8th ICS at highest point
- Cranial border of rib
- 19g butterfly or 14-18g ONC

Chest tube placement
Highrise Cat

• QUATS
  • Hct/TP 38% and 6.2 g/dL
  • Stress hyperglycemia (13mmol/L)
  • pCO2 56mmHg
  • Mild metabolic lactic acidosis
• aFAST
  • 0/4 quadrants
• sFAST
  • Absent glide sign
  • No pleural or pericardial effusion
  • Possible Blines/contusions

• Detailed Exam
  • Symphysal fracture with minimal misalignment
  • Hard palate split
  • Left tibial FF

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Highrise Cat

Revised Assessment

• Stable pneumothorax with risk of decline/delayed complications
• Fractures requiring sx repair
• Revised Plan
  • Monitor RR/cheest tube pending progression
  • Analgesia as needed for pain
  • Metacam (if remains stable)
  • Sx repair once thoracic pathology stable +/- Etube

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Hemoabdomen

• 4yr old FS mix breed
• Routine uncomplicated OHS 24hrs prior
• Quiet overnight but ate small amount
• Progressively weaker overnight
• Reluctant to urinate outside this morning
• Anorexic but drinking excessively

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Hemoabdomen

- Primary Survey
  - Dull
  - Carried in – unwilling to walk
  - MM pale, CRT > 2sec
  - Mild tachypnea
  - Tachycardic (176bpm) with intermittent irregular beats
  - Weak to absent pulses deficits
  - Mild discharge from incision
  - Mild discomfort on palpation

- Initial Assessment
  - Decompensatory shock
  - Arrhythmic
  - Pain

- Initial Therapeutic Plan
  - IV access
  - Fluid resuscitation
    - PLA 10-20ml/kg
  - Analgesia
    - Methadone 0.1-0.2mg/kg

- Initial Diagnostic Plan
  - ICU Quats
    - Hct/TP 28% and 51 g/dL
    - Mild hyponatremia (136 mmol/L)
    - Moderate metabolic lactic acidosis
    - ACT 128 sec
  - Platelet estimate 85-100,000 UL
  - VPCs with periods of Vtach
Hemoabdomen

- Non-compressible hemorrhage
- Etiology
  - Coagulopathy (e.g., rodenticide)
  - Traumatic
  - Neoplastic
  - Post-op DHS, splenectomy, GDV, liver biopsy
- Hypovolemia > Anemia

- Resuscitation targets
  - SAP 90mmHg/MAP 60mmHg
  - Improved perfusion parameters
    - Mentation
    - Tachycardia
    - CRT/MM
    - RR

Hemoabdomen

- Medical Management
  - Judicious volume resuscitation
  - Estimation of blood loss
    - 85% of BWT x % loss
    - 65% of BWT x % loss
  - Crystalloid boluses
  - +/- Voluven boluses
  - Blood transfusions

- Surgical Management
  - Refractory to medical therapy
  - Limited resources
  - aFAST score
  - Initial
  - Serial
  - SAP 90mmHg/MAP 60mmHg

- Blood transfusions
  - Hypovolemia not anemia
  - Whole blood
    - Fresh
    - Stored
  - Component
    - pRBC
    - FFP
    - Platelets
Autologous blood transfusion

Hemoabdomen

- Surgical Management
  - Refractory to medical therapy
  - Limited resources
  - aFAST score
    - Initial
    - Serial

- SAP 90mmHg/MAP 60mmHg

Parvovirus

- 3mth old FI mixed breed
- Acquired from Kijiji breeder 1 week prior
- Unknown vaccination status.
- No concerns at rDVM post-purchase exam. Dewormed
- Lethargic x 48hrs
- V+/D+ overnight
- Uninterested in eating past 24hrs
Parvovirus

• Primary survey
  • Quiet (especially for puppy)
  • MM pink but tachy. CRT < 2 sec
  • RR/effort wnI
  • Sinus with palpable dpp
  • Temp 37.2C
  • Thin body condition
  • Groaning on abdominal palpation
    * no pain
    * no palpable SI intussusception

• Initial Assessment
  • Dehydrated 5-6%

• Initial Plan
  • Fecal r/o Parvo & endoparasites
  • Outpatient vs Inpatient

Parvovirus

• Viral infection
  • Symptomatic therapy
  • Biphasic disease

• Principles of management
  • IV rehydration
  • Electrolyte supplementation
  • Antibiotics +/- antiparasitic
  • Antiemetics +/- analgesia
  • Enteral support

• Complications/Limitations
  • Financial constraints
  • Sepsis (septic shock)
  • Aspiration pneumonia
  • SI Intussusception

Parvovirus

• Diagnostic Plan
  • ICU Quats (baseline)
  • Serial BG/Electrolytes/PCV/TP
  • CBC +/- trend

• ICU Quats
  • Na+/Cl 138/110
  • K+ 3.2 mmolL
  • BG 4.0 mmolL
  • Lactate 1.9 mmolL
Parvovirus

- Fluid Plan
  - Fluid boluses until normotensive
  - Rehydration
    - % dehydration × BWt × maintenance over 12-24hr
  - Ongoing losses

- Electrolyte Supplementation
  - K+
  - Dextrose
  - Total protein (< 4.0 g/dL)

Refractory Hypotension

- Hypovolemic shock
  - Crystalloids
  - Colloids
  - PP/FFP

- Distributive shock (septic)
  - Pressors (Dopamine or NorEpi)

- Ancillary support
  - Active rewarming
  - Normoglycemia

Parvovirus treatment

- Antibiotics
  - Ampicillin +/- enrofloxacin/amikacin
  - Cefoxitin

- Antiemetics
  - Maropitant vs Ondansetron
  - Metoclopramide

- Analgesia
  - Butorphanol vs Buprenorphine
  - Opioids and GI stasis/cramping
Nutritional support

- Oral supplementation
  - Higher risk of aspiration
  - Food aversion
  - Cost effective

- NG supplementation
  - Reduced risk of aspiration
  - Gastric decompression
  - Patient friendly

Effect of early enteral nutrition on intestinal permeability, intestinal protein loss, and outcome in dogs with severe paroviral enteritis.

- Earlier clinical recovery and weight gain
- No survival benefit

Parovirus (outpatient)

Evaluation of an outpatient protocol in the treatment of canine paroviral enteritis.

- SubQ fluids, Maropitant, Convenia
- Oral supplementation for dextrose/K+
- 80% survival vs 90%
- Patient selection improves outcome
  - Patient status & owner compliance
- Daily assessments
  - Phone vs in person consult

Parovirus (outpatient)

Evaluation of mortality rate and predictors of outcome in dogs receiving outpatient treatment for paroviral enteritis

- SubQ fluids, antiemetic, antibiotics +/- oral supplementation
- Outpatient treatment
- 75% survival at 3 days
- 81% survival with oral supplementation
Urethral obstruction

- 5yr old MN DMH
- P.C. Lethargic and vocalizing
- 2-3 day history of decreasing appetite

Primary survey

- Obtunded and recumbent
- Relative bradycardic (165 bpm) with weak dpp
- Short, shallow breathing
- Temp 36.7C
- Vocalize on abdominal palpation
- Large, firm and non-expressed urinary bladder

Assessment

- Critical – urethral obstructions
- Likely hyperK+ and uremic/acidosis
- Immediate IV access warranted
ICU Quats

- PCV 36%, TP 65 g/L
- K+ 9.6 mmol/L, iCa+ 1.08 mmol/L
- BG 11.2 mmol/L
- Marked metabolic lactic and uremic acidosis
- Creatinine 1465 umol/L

Treatment Plan (UO)

- Cardiac stabilization
- Ca gluconate (0.5mL/kg slow IV)
- IV fluid bolus (PLA or Normosol-R)
- Treatment of hyperK+
  - Dextrose (0.5mL/kg IV)
  - +/- R-insulin (0.25U/kg IV) + dextrose infusion
- Urethral unblocking
  - Hydro 0.25-0.05mg/kg IV + Diazepam 0.5mg/kg IV
- Adjunct
  - Analgesia PRN +/- antispasmonic

Treatment Plan (AKI)

- Cardiovascular stable
  - Continue IV fluid boluses until normotensive
  - Ensure normothermic
  - +/- pressor support
- IV fluid support
  - Rehydrate over 12-24hrs
- Monitor Urine output
  - Indwelling ucath
  - Measure UO and adjust fluids q6hrs
Diagnostic Plan (AKI/UO)

- Minimum
  - Urinalysis +/- creatinine
  - Abdominal Xray (cystic calculi)

- Ideal
  - CBC/Chemistry/UA
  - +/- Urine C&S pending UA
  - Abdominal x-rays r/o cystic calculi
  - +/- AUS

Management Success

- Survival 90-95%
- Recurrence rate 15-40%
  - Duration and size of indwelling ucath may impact
  - Water intake and environmental modifiers reduce recurrence
  - Urine color at time of removal may impact
  - Prasozin? phenoxycbenzamine? Meloxicam? None?

Outpatient UO

- Recurrence rate
  - 11% indwelling (5/46) and 31% outpatient (14/45)

  - 73% success (11/15)
  - Cystocentesis, analgesia/sedation and subQ fluids
  - Candidate selection
Penile Urethrostomy

QOL – 0% less & 48% better
88% report good QOL
10% severe recurrent UTI

10% severe recurrent UTI