MANAGEMENT OF FHF ON THE ICU

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Objectives

- Define Fulminant Hepatic Failure
- List causes of FHF
- Revisit liver functions
- Highlight symptoms and presentation
- Discuss management on the ICU

Definition of FHF

Described over 40 years ago by Trey and Davidson (1968) as

"onset of altered mental status within 8 weeks of initial symptoms in an otherwise healthy individual with no previous history of liver disease"

Alternative terminology

Fulminant -reserved for encephalopathy occurring < 2 weeks after onset of symptoms

Subfulminant - encephalopathy occurs within 2 weeks to 3 months

Late onset – 8 to 24 weeks

"Umbrella" term - depending on jaundice to encephalopathy time interval

- Hyper-acute (onset within 7 days)
- Acute (between 8 and 28 days)
- Sub-acute (29 days and 12 weeks)

Causes of FHF

Drugs and toxins - 55 %

- Paracetamol leading cause in UK/USA
- Rifampicin, MDMA, herbal

Viral – **35 %** hepatitis , CMV ,EBV

Ischaemic – shock, hepatic vascular occlusion (Budd - Chiari)

Others –

- Tumour
- Fatty liver of pregnancy
- HELLP
- Auto-immune
- Wilsons disease
- Primary graft non function post OLT

Liver functions

- Bile production (800-1000mls/24hrs)
- Glycogenesis
- Lipid – synthesis and catabolism
- Protein – deamination (ammonia converted to urea)
- Storage of vitamins (ADK and B12)
- Synthesis of most blood clotting agents – prothrombin , fibrinogen and factors V,VII,VIII,IX,XI,XII
- Destruction of erythrocytes
- Detoxification –drug's, alcohol, chemicals, gut organisms
- Heat production – under basal activity liver produces most heat.

Symptoms and presentation

History – vital in confirming diagnosis and early treatment (80% mortality)

Symptoms – often vague mainly anorexia, nausea, abdominal pain, jaundice

Respiratory – hyperventilation and hypoxia (fluid overload, bleeding)

CVS

- Hypotension - dilated with high cardiac output (C.I >5l/m)
- Coagulopathic (low platelet count with high PT) often visible bleeding from gum's, lines
- Metabolic and lactic acidosis
- Raised liver enzymes – ALT often in thousands

Renal

- Elevated u&e' s
- ARF (50% POD's)
- ATN, pre renal, hepato-renal syndrome

Creatinine more sensitive indicator of renal function

Symptom's and presentation

Neurological hepatic encephalopathy (hallmark feature)

Grade –

I slowness of mentation
II drowsiness, inappropriate behaviour
III rousable, incoherent , marked confusion
IV not rousable, may/may not respond to pain

GI - hypoglycaemia, electrolyte imbalances, GI bleeding
Skin - jaundice, bleeding, bruising
Hepatic fetor – breath of the dead !

Management of FHF on the ICU

Management of FHF

Why ventilate –

- Airway protection
- Neuroprotection
- To manage patients (agitated / aggressive due to encephalopathy)

Usual ABCDE's and glucose

Bloods – see protocol for guidance, but includes :-

- Routine admission bloods FBC, U&E's, LFT's , clotting
- Ammonia
- Arterial blood gas – particularly lactate and glucose
- Urgent group and save

Viral screen – hepatitis, EBV,CMV,HIV other micro as guided by hepatology

Urine / blood for toxicology (paracetamol , recreational)

Routine – 12 lead, X-ray for COETT/ line insertion

Respiratory

- Controlled mode – usually SIMV
- Aims of ventilation ***PaO_2 10 -12 Kpa $PaCO_2$ 4.5-5 Kpa***
- Avoid ALI – over-ventilation, fluid overload, and infection as >80% oxygen may preclude listing or OLT
- VAP rules apply – 30 degrees head up, sub-glottic suctioning
- Deeply sedate with propofol and alfentanil. No wake and wean in acute phase
- Gentle suctioning – methodical assessment, as opposed to routine
- Hyperventilation – not routinely carried out danger of ALI and cerebral ischaemia
- Tapes not ties for COETT
- Humidification – wet circuit may help reduce Co2

Cardiovascular

- Monitoring – ECG, left radial A-line ,CVP (5 lumen) temperature probe
- Advanced – PA catheter, LidCo ??

- Targets > **MAP > 70-80 mmhg** and **CVP 5 -10 mmhg**

- Inotropes for vasodilation (noradrenaline often high dose)

- Keep HB>80 g/l and only treat coagulopathy if problematic or has **met** criteria for listing for liver transplant. Consultant decision.

- Criteria depends on cause or category of FHF generally based on H+, PT, creatinine and encephalopathy **e.g.** POD is as follows –

  H+>50 and PT >100, Cr >300 or anuria, and grade 3 or 4 encephalopathy

- Temperature control

Cardiovascular continued

- ***Infection prevention crucial as liver patients are susceptible to infection.***
- ***Infection may be detrimental and preclude OLT***

Prevention –

- Aseptic line insertion
- Invasive line maintenance
- Meticulous hand hygiene

Prophylaxis

- Co-amoxiclav 1.2g TID (ciprofloxacin 400mg BD/vancomycin infusion with penicillin allergy)
- Fluconazole following intubation then 400mgs daily

Detection

- Monitor WCC, temperature masked by CVVHD/cooling
- Infection screening as indicated

Renal

- BD monitoring of U&E
- IDC and 1 hourly urine volumes
- Accurate 1 hourly running total fluid balance
- Early introduction of CVVHD - see protocol.
- No need for anticoagulation in first instance.
- Avoid hyponatraemia aim Na+ 140-145mmol/l

Neurological

- Raised ICP most common cause of death **(50-80%)** in FHF and not detectable until life threatening !
- No longer insert ICP monitoring – risk of ICH
- Pupils – **at least** hourly pupils checks using pupilometer
- Daily ammonia >150 risk of cerebral oedema
  >200 risk of cerebral herniation
- Follow basic neuroprotective parameters and treat with hypertonic therapy as per protocol

Gastro-intestinal

- NGT and gut decompression– note FHF patients are coagulopathic so caution exerted on insertion
- Enteral feeding commenced as protocol
- Gastric ulcer protection with Pantoprazole 20 mgs daily
- 1 hourly blood glucose monitoring with ***normoglycaemia*** maintained with continuous 50% dextrose. Aim blood glucose above 6 mmols.
- BD biochemistry (electrolytes and LFT's)

Gastrointestinal / Paracetamol ingestion

Risk factors for paracetamol toxicity

- Dose (12g quoted as critical / patients may develop toxicity at much lower doses)
- Hepato-cellular necrosis thought to be maximal 3-4 days post ingestion

<u>Factor's that increase risk</u>

- Enzyme inducing drugs – anticonvulsants, rifampacin
- Staggered and / or
- Accidental (often staggered and present late)
- Low BMI or malnourished
- Chronic alcohol consumption

<u>Factors that reduce risk</u>

- Acute alcohol consumption

Gastrointestinal

Treatment based on paracetamol levels **4 hours** after ingestion

Paracetamol treatment graph – time post ingestion vs. plasma concentration
N-acetylcysteine – provides liver protection if given within 12hrs .

NB *Accurate patient weight vital for dosing*

- 150mgs/kg over 1 hours
- 50 mgs/kg over 4 hours
- 100mgs/kg over 16hours
- NAC final (16hr) infusion continues until PT falling or patient has been transplanted

Other treatment's (seldom used)

- Albumin dialysis (MARS machine)
- External Liver Assist Device (ELAD)

Skin and pressure area care

- Meticulous eye (Lacrilube / hypromellose) and mouth care vital
- Soft toothbrush, small suction catheter if bleeding / reposition COETT
- Nimbus mattress with PAC as able / Passive limb exercises
- Maintain alignment particularly when side lying
- DVT prophylaxis TED's/ pneumatic pump +/- heparin (when coagulation normal post transplant)
- Infection prevention – complete medical device sheet

Outcome of FHF

- Requires early diagnosis and treatment
- Threefold – improve, get worse or require transplant

<u>Transplantation</u>

Must meet criteria based on

- H+
- PT
- Creatinine
- Encephalopathy

Extensive assessment (medical and psychiatric history)

- MDT discussion
- Condition and likelihood of recovery
- Likelihood of patient compliance

Contraindications to transplant

- Active drug or alcohol abuse
- Recurring suicidal behaviour / psychiatric disorders
- Medical history – HIV, chronic liver disease or malignancy
- Neurological damage, infected, physiologically unfit for surgery, age > 60 yrs

During /Post OLT

- May require CVVH during surgery
- Surgery can be risky and stormy
- ICP resolves almost immediately once portal vein clamped / transient rise during reperfusion of new graft

Admitted back to ICU

- 1 hourly ABG post op (glucose/lactate).
- Full bloods at 1,6,18 and 24 hours post surgery
- USS of liver check portal blood flow(CT may be required)
- Antibiotics, antifungals, hydrocortisone and immunosuppressant
- Main complications

Infection
Bleeding
Primary graft non function
Rejection (late)

- ITU support downgraded as bloods and condition indicate
- Patient transferred to ward 215 when stable as L2 patient

Conclusion

- Defined FHF
- Listed causes of FHF
- Revisited liver functions
- Highlighted symptoms and presentation
- Discussed care of FHF on the ICU
- Highlighted criteria and care for liver transplant

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Question Time