Liver Failure Syndromes

Treatment and management

Potential Categorization of liver dysfunction in critical care /MOF

Primary liver Injury Acute

Acute liver Injury

Acute Liver Failure

Chronic liver failure

Decompensated CLD

Acute on CLD

Surgical

Hepatectomy

Trauma

Liver Bx / ERCP

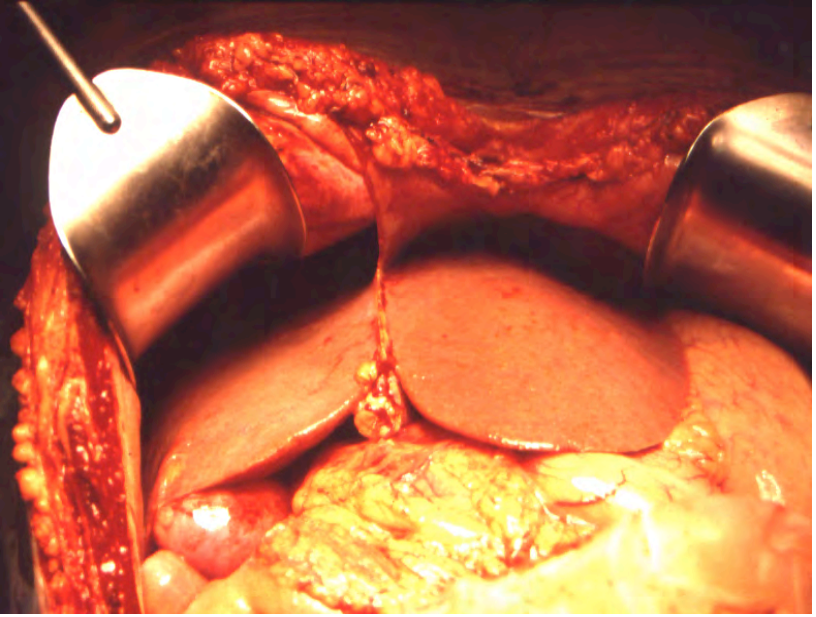
Secondary liver Injury

Sepsis / inflammation

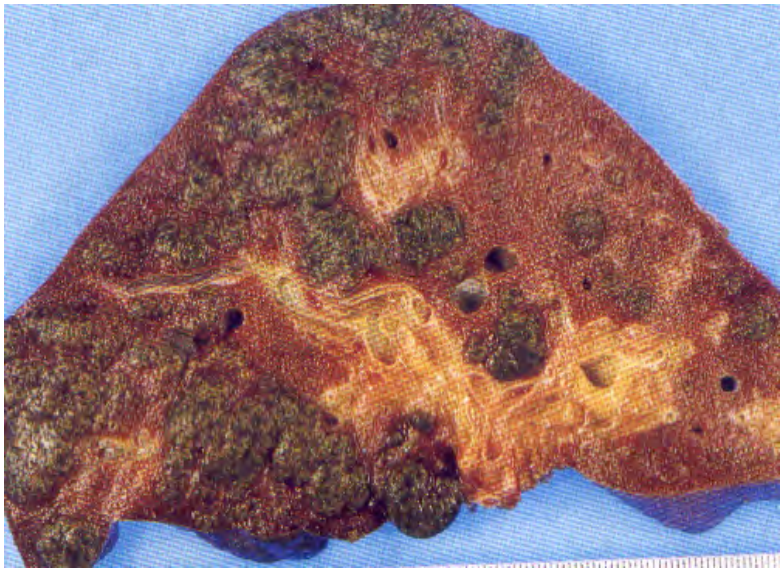
Systemic disease

Drugs ; cholestasis

Other…..



Hyperacute < 7 days
Acute 1 -4 weeks
Subacute 4-12 weeks



Acute Liver Failure

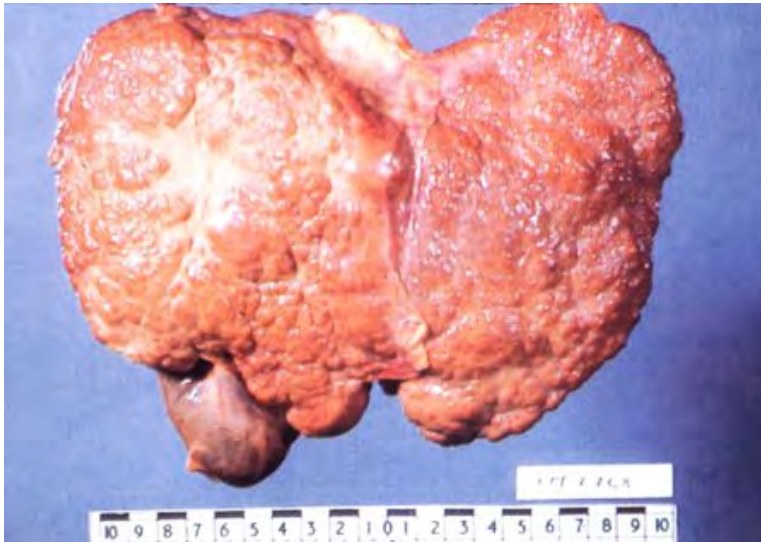
Primary liver injury

Coagulaopthy

Encephalopathy

No preexisting liver disease

Cirrhosis



Principle Causes of Acute Liver Failure

Cause	Agent responsible
Viral hepatitis	Hepatitis A, B, D E, CMV, HSV, Seronegative
	indeterminate hepatitis (14 - 25% of cases)
	Reactivation of HBV Chemotherapy , steroids : antiviral Rx
Drug related	Paracetamol, Anti tuberculous drugs, lipid
	Recreational drugs, Idiosyncratic reactions anticonvulsants, NSAI, HARRT etc, etc
Toxins	Amanita phalloides
Vascular events	Hypoxic Hepatitis, VOD, Budd-Chiari
	Hyperthermia induced ALF (NMDA, excercise)
Pregnancy related	Liver rupture, HELP, fatty liver
Other	Lymphoma, carcinoma : imaging , LDH, AlKP04
	Wilson disease : low AlkP04, haemolysis, spleen
	Weils / leptospirosis – not really ALF .....

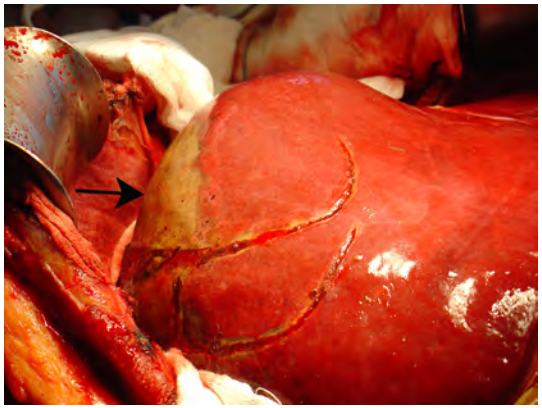
Management

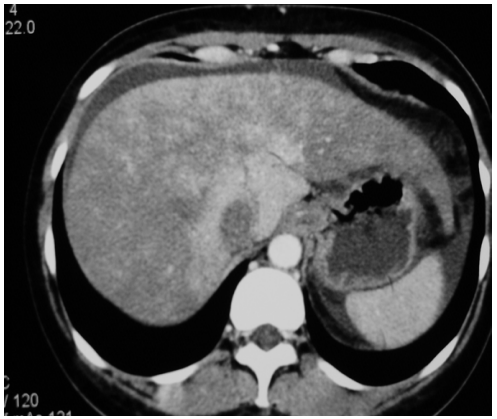
- Diagnosis
  - Imaging
  - Role of biopsy
- Supportive therapy to allow scenario for liver regeneration or stability for transplantation
  - CVS
  - Respiratory
  - CNS
  - Renal
  - Feeding
  - Sepsis
  - Coagulation – monitor do not Rx
  - G-I : consider pancreatitis

Consider Tf / discuss with tertiary centre

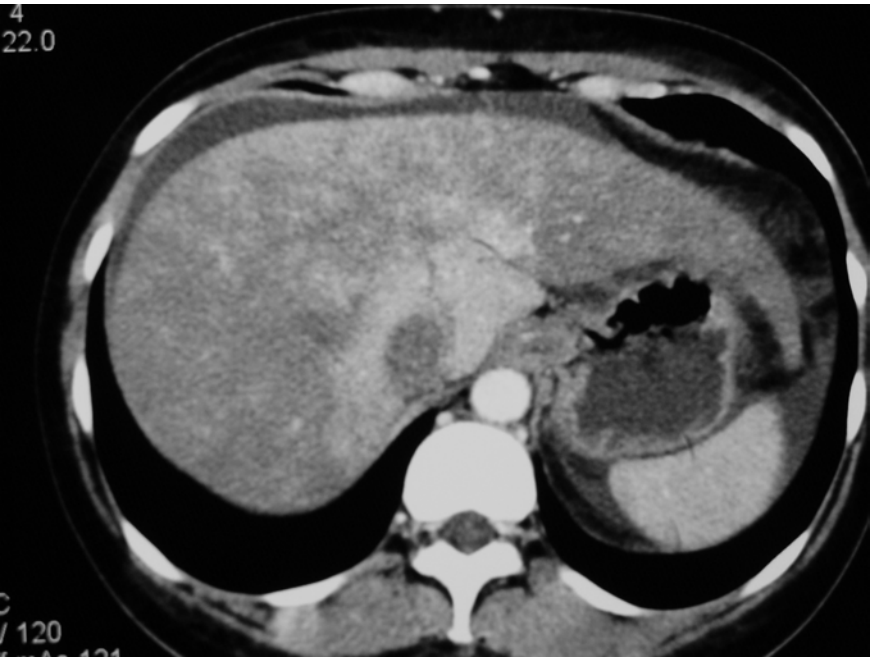
Treatment / prevention

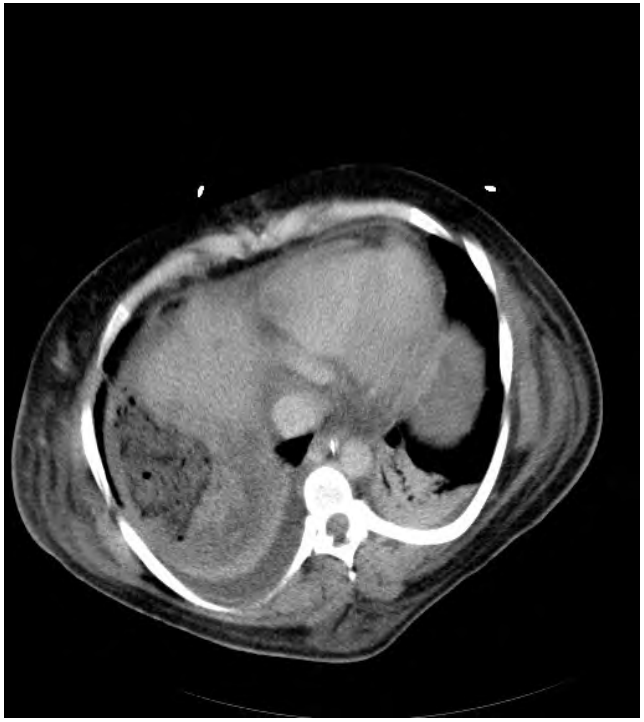
- Antiviral therapy in hepatitis B, CMV, HSV
  - N-acetyl cysteine *Harrison et al keays et al 1992 BMJ,* Lee W Gastroenterology 2009, Dig Dis Sci (2013) 58:1397–1402 , Liver Int. 2013: 33: 1324–1331 (IL-17)
- Removal of potential toxic drugs
- TIPS shunt in acute Budd Chiari
- Delivery in pregnancy related pre-eclampsia





Pregnancy related liver disease



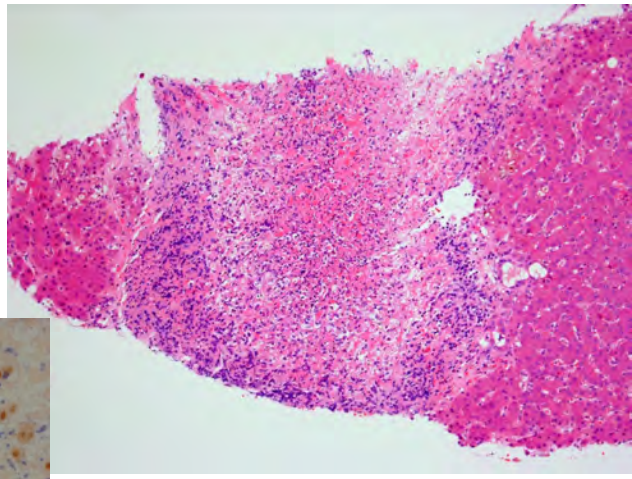


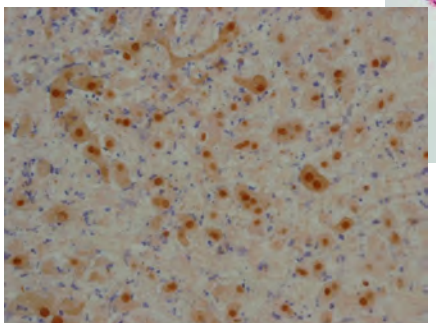
Imaging

Diagnosis

Be open to rare diagnoses

Imaging and blood tests





HSV and pregnancy

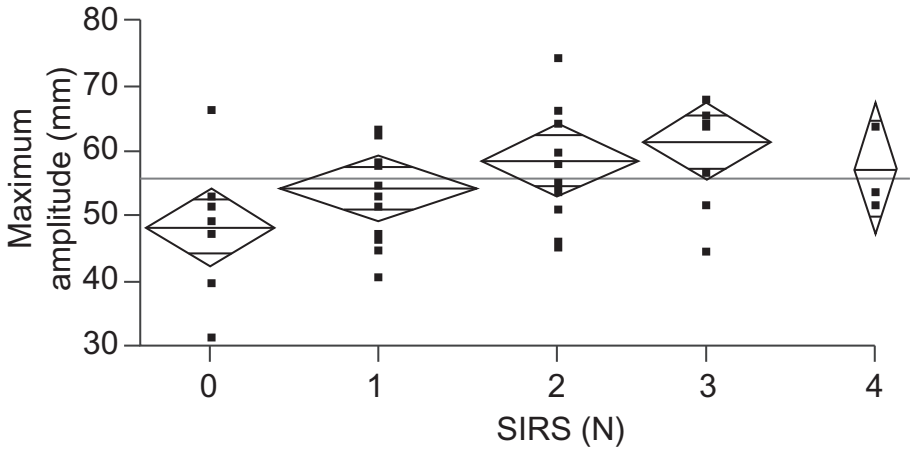
Transfer issues

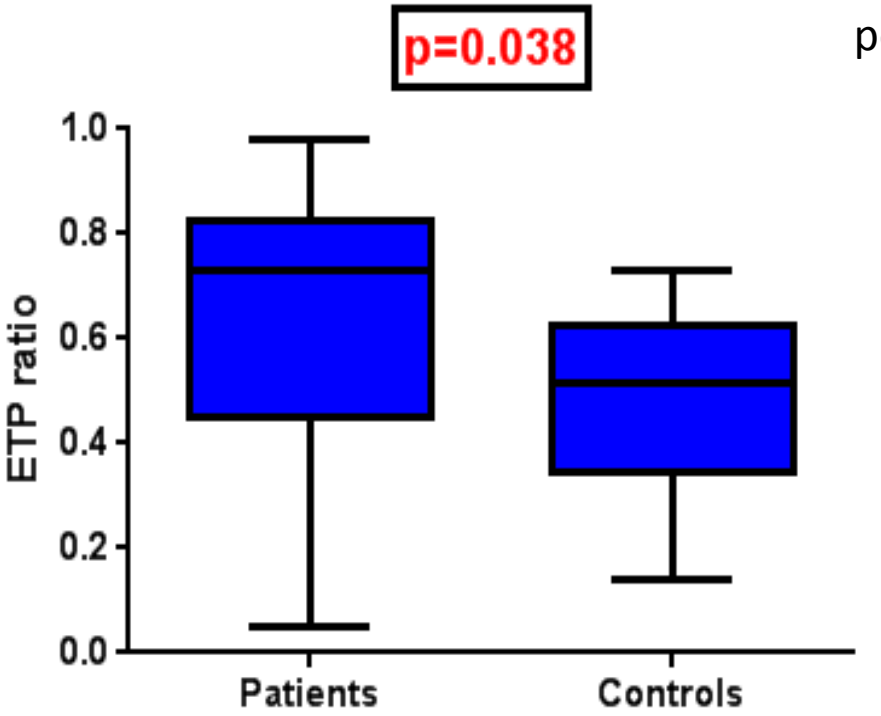
1. Early transfer to a Tp centre
2. Elective ventilation if GCS changing
3. Observe pupils
4. Fluids
5. Noradrenaline
6. Mannitol for pupil abnormalities

Minimal effects of acute liver injury/acute liver failure on hemostasis as assessed by thromboelastography

Journal of Hepatology **2012** vol. 56 | 129–136

Feature	Normal Range	Entire Group (n = 51)	Spontaneous Survivors (n = 29)	Death or OLT (n = 22)
Fibrinogen (mg/dl)	200-450	195 ± 84	223 ± 55	154 ± 102**
PTT (sec)	25-36	49 ± 17	41 ± 10	59 ± 19****
INR		3.4 ± 1.7	3.0 ± 1.3	4.0 ± 1.9*
MELD score		31.3 ± 8.6	27.7 ± 7.1	36.2 ± 8.3***
TEG Parameters:				
R-time (min)	2.5-7.5	4.7 ± 1.9	4.1 ± 1.5	5.5 ± 2.2**
K-time (min)	0.8-2.8	1.7 [0.8-20.0]	1.9 [0.8-20.0]	1.7 [0.9-10.5]
α-Angle (degrees)	55.2-78.4	63.7 ± 12.2	63.6 ± 12.7	63.7 ± 11.8
Maximum Amplitude (mm)	50.6-69.4	55.0 ± 10.9	55.0 ± 11.2	55.1 ± 10.6
Lysis 30 (%)	0.0-7.5	0.0 [0.0-2.1]	0.0 [0.0-1.8]	0.0 [0.0-2.1]





ETP endogenous thrombin potential ratio suggesting hypercoagulability.

Liver Int 2013

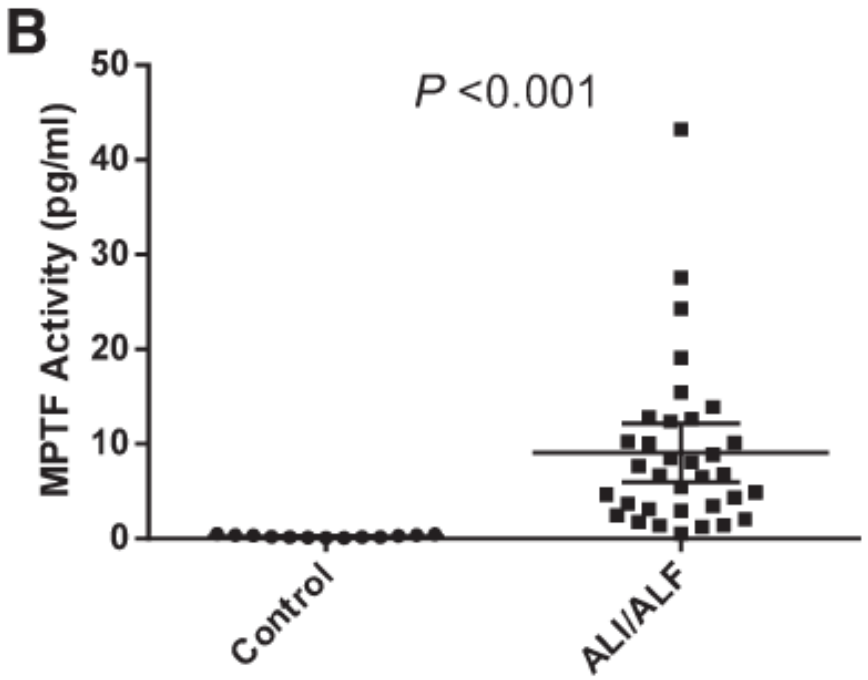
abnormal coagulation decreased clotting factors except FVIII.

Decreased anticoagulant factors and thrombin generation.

Intact haemostatic capacity when TG was measured in the presence of thrombomodulin .

Role of Procoagulant Microparticles in Mediating Complications and Outcome of Acute Liver Injury/Acute Liver Failure

R. Todd Stravitz, HEPATOLOGY 2013;58:304-313)



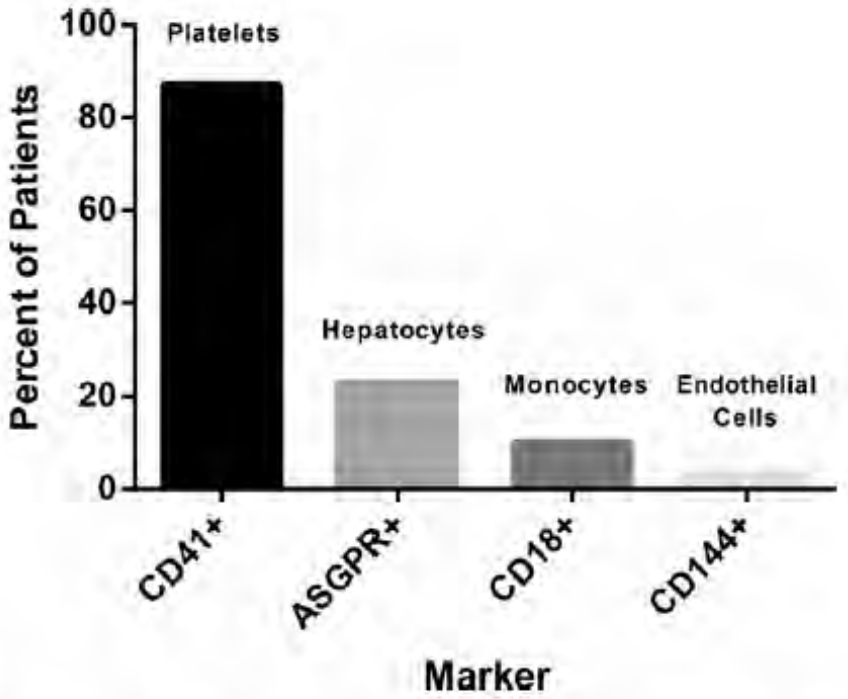


Fig. 5. Prevalence of MP phenotypes in plasma of patients with ALI/ALF by flow cytometry.

Lung Injury and Its Prognostic Significance in Acute Liver Failure

CCM March 2014 • Volume 42 • Number 3

Georg Auzinger

148 patients with ALF

21% incidence of ALI/ARDS

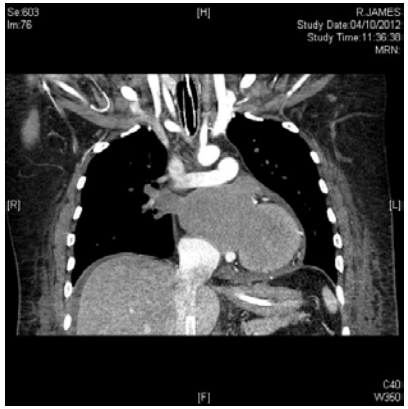
No effect on mortality

ITU LoS longer 9 vs 19 days ($p<0.01$)

EVLWI had a sensitivity of 65% &
specificity of 77% in prediction of ALI/ARDS

Simplified Acute Physiology Score	52 (12–97)	52 (23–92)	0.780
Sequential Organ Failure Assessment	15 (6–21)	16 (8–20)	0.886
Liver intensive therapy unit stay (d)	16 (1–59)	19 (2–140)	0.086
Ventilator days	10 (–50)	15 (2–41)	0.020
Outcome (dead/transplanted:spontaneous survival)	69:48	17:14	0.883

CVS management



- Volume
- Avoid right sided overload
- Cardiac injury / disease
- Vasopressor
  - Norepinephrine / vasopressin
- Role of hydrocortisone
- Consider HH

Troponin
Often elevated –0.1 up to 24 ng/L
OR death 3.8 for > 0.1
Parekh Hepatology 2007 45:1489

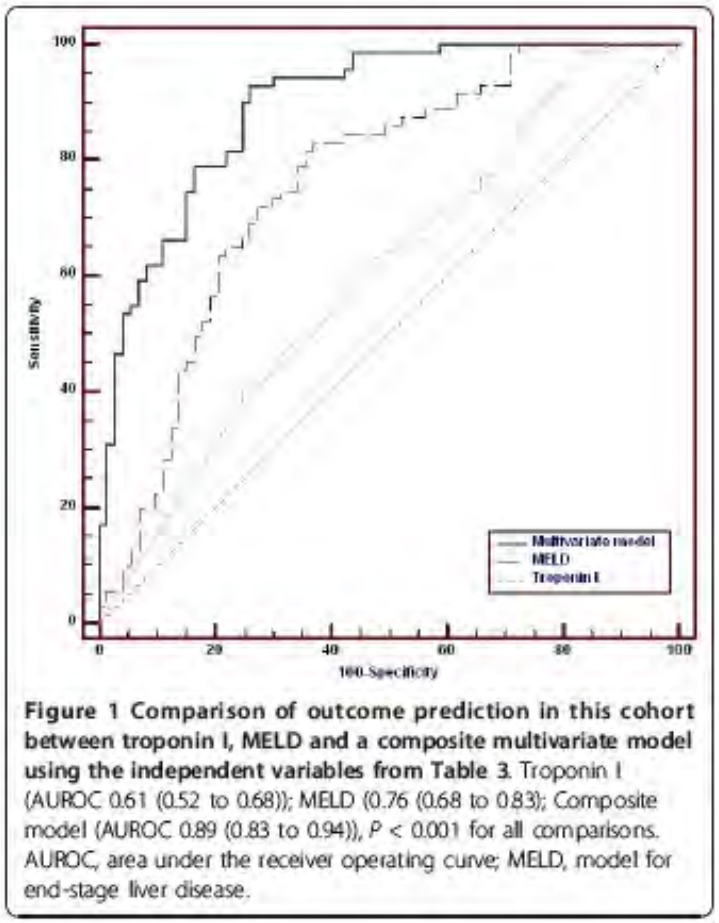


Figure 1 Comparison of outcome prediction in this cohort between troponin I, MELD and a composite multivariate model using the independent variables from Table 3. Troponin I (AUROC 0.61 (0.52 to 0.68)); MELD (0.76 (0.68 to 0.83); Composite model (AUROC 0.89 (0.83 to 0.94)), $P < 0.001$ for all comparisons. AUROC, area under the receiver operating curve; MELD, model for end-stage liver disease.

Audimooolam et al. Critical Care 2012, 16:R228
Fin larsen et al Harry et al Hepatology 2002

Hypoxic hepatitis

Global haemdynamics vs splannchnic haemodynamics

Inadequate hepatic arterial inflow / oxygenation

Portal venous inflow issues

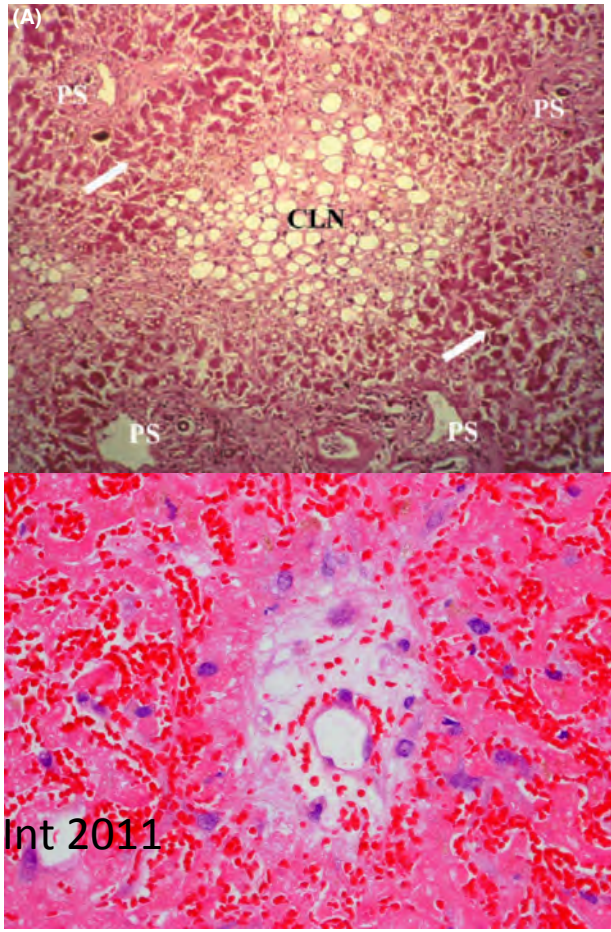
Hepatic venous outflow

- R heart issues
- veno-occlusive disease
- sickle hepatopathy, malaria

Microcirculatory abnormalities

Intra-abdominal hypertension

Infiltration (lymphoma, adeno, leukaemia)



1. Henrion et al Medicine 82 : 6 ; 2003, Liver Int 2011
2. Mayo Clin Proc 2006 81(9) :1232

Prevelance 1.5 -12%

Table 3. Clinical conditions underlying hypoxic hepatitis in the five largest and most recent series

Author date (ref.)	Henrion 2003 (2)	Birrer 2007 (3)	Fuhrmann 2009 (5)	Chang¶ 2008 (20)	Raurich § 2010 (7)
No. of cases	142	322	118	75	182
S-AT x ULN *	20	10	20	75	20
Heart failure	100 (70%)	201 (62%) †	61 (52%) ‡	47%	71 (39%)**
Respiratory failure	19 (13%)	45 (14%) †	23 (20%) ‡	11%	<7%
Septic shock	19 (13%)	52 (16%) †	37 (32%) ‡	32%	60 (32%)

Table 4. Hemodynamic assessment in hypoxic hepatitis caused by cardiac failure (results expressed as medians)

Author (ref.)	J. Henrion (2)	B. Birrer (3)	Normal values (36)
No. of cases	73	198	–
CVP (cm H_2O)	21	20	1–9
CI (L/min.m^2)	1.97 (*n* = 34)	1.91	2.8–3.6
DO_2 (ml/min.m^2)	350 (*n* = 34)	325	520–720
PaO_2 (mmHg)	64	84	80–98
HBF (ml/min.m^2)	795 (*n* = 18)	778	2100*

Table 5. Hemodynamic assessment in hypoxic hepatitis because of respiratory failure (results expressed as medians)

Author (ref.)	J. Henrion (2)	B. Birrer (3)	Normal values (36)
No. of cases	19	51	–
CVP (cm H_2O)	17.5	16	1–9
CI (L/min.m^2)	3.8 (*n* = 8)	3.9	2.8–3.6
DO_2 (ml/min.m^2)	394 (*n* = 8)	382	520–720
PaO_2 (mmHg)	34	32	80–98
HBF (ml/min.m^2)	1283 (*n* = 4)	1304	2100*

DO_2, oxygen delivery; CI, cardiac index; CVP, central venous pressure;

Hepatopulmonary Syndrome in Patients With Hypoxic Hepatitis

GASTROENTEROLOGY 2006;131:69–75

VALENTIN FUHRMANN,* CHRISTIAN MADL,* CHRISTIAN MUELLER,† ULRIKE HOL
REINHARD KITZBERGER,* GEORG–CHRISTIAN FUNK,§ and PETER SCHENK*

*Intensive Care Unit 13H1; †Division of Gastroenterology and Hepatology; §Pulmonary Division, Department of Inte
University Vienna, Vienna, Austria

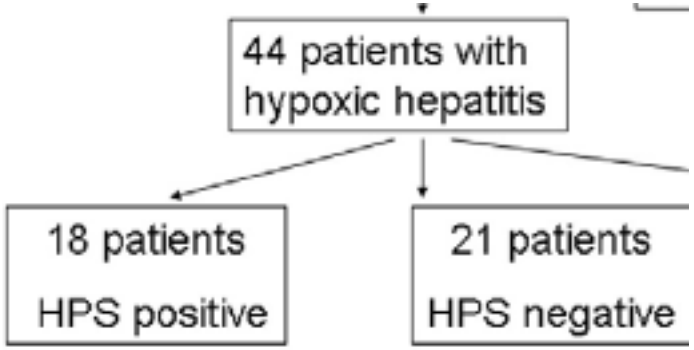


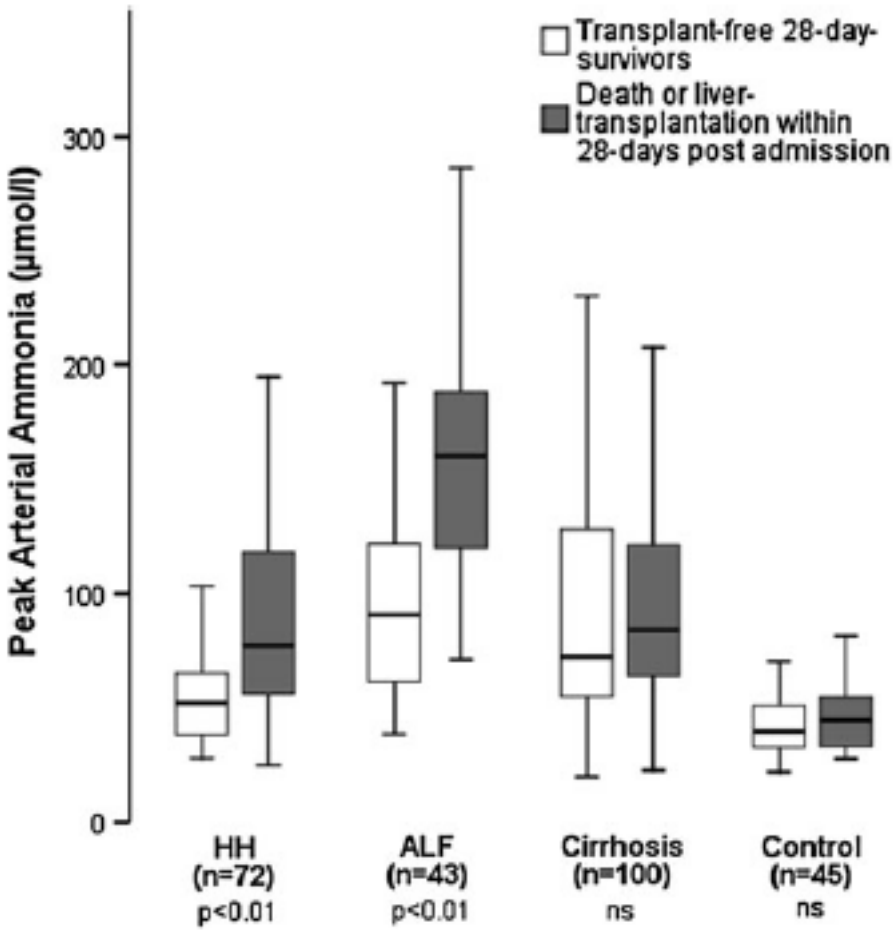
Table 2. Arterial Blood Gas Analysis and Respiratory Parameters During CEE in Patients With HH

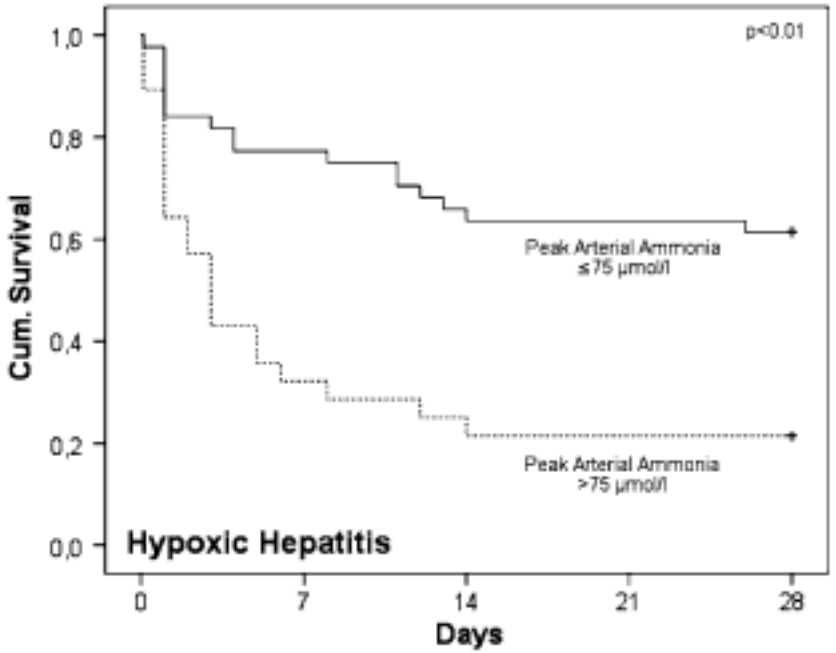
	HPS-positive patients	HPS-negative patients	*P* value
Arterial blood gas analysis during CEE			
pH	7.34 ± .15	7.40 ± .06	NS
PaO_2, *mm Hg*	76 ± 11	92 ± 16	.001
$PaCO_2$, *mm Hg*	40 ± 15	40 ± 9	NS
$AaDO_2$, *mm Hg*	231 ± 126	204 ± 118	NS
Respiratory parameters in mechanically ventilated patients during CEE			
PEEP, *mbar*	7.5 ± 2.8	8.9 ± 4.1	NS
P max insp, *mbar*	22.2 ± 5.3	22.9 ± 6.2	NS
Tidal volume, *mL*	485 ± 90	531 ± 152	NS
Respiratory rate per minute	18 ± 5	16 ± 5	NS
PaO_2/FiO_2	152 ± 61	203 ± 63	.034
$AaDO_2$, *mm Hg*	266 ± 102	215 ± 112	NS
AUC_{48hr} of PaO_2/FiO_2, *mm Hg · h*	7465 ± 2409[a]	11,620 ± 4281[b]	.009

: 01 May 2013

Andreas Drolz

Clinical impact of arterial ammonia levels in ICU patients with different liver diseases





Screen for HPS : 50%

Gastroenterology 2006 : 131

Main priority is to support CVS and respiratory systems

Liver will recover

Acute kidney injury in patients admitted to a liver intensive therapy unit with ALF . *O'Riordan A*

Nephrol Dial Transplant (2011) 26: 3501–3508

Period 2000-2007 : 302 ALF managed without OLT

21% did not develop AKI : all survived

239 with AKI of whom 164 survived

Lactate 2-7
INR 2-5

51% return of normal renal function
eGFR > 60 discharge

7% required on going haemodialysis at time of discharge
At 30 days post discharge of this group eGFR was 20
At 90 days none dialysis dependant and eGFR > 60
AKI does not impact on outcome om mutivariate analysis

Nephrol Dial Transplant. 2011 Nov;26(11): 3501-8.

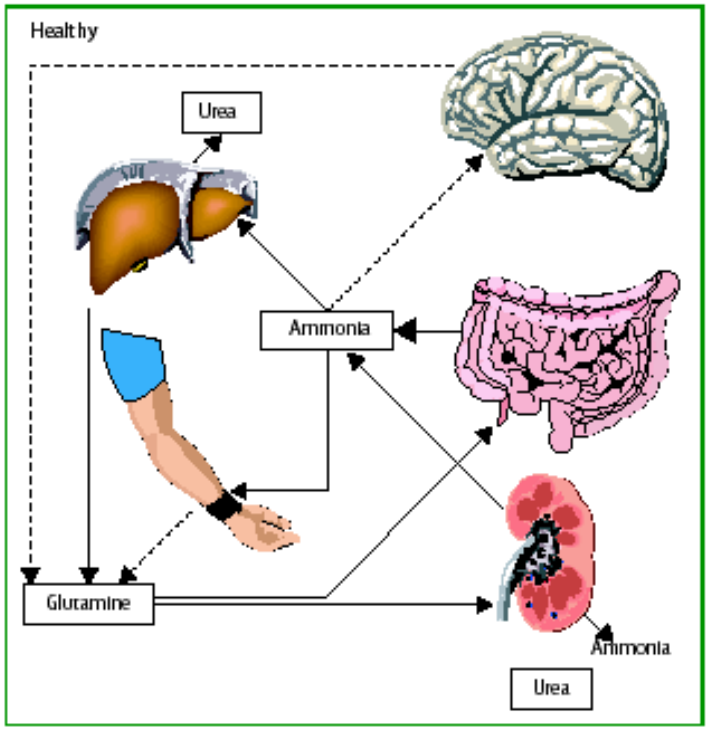
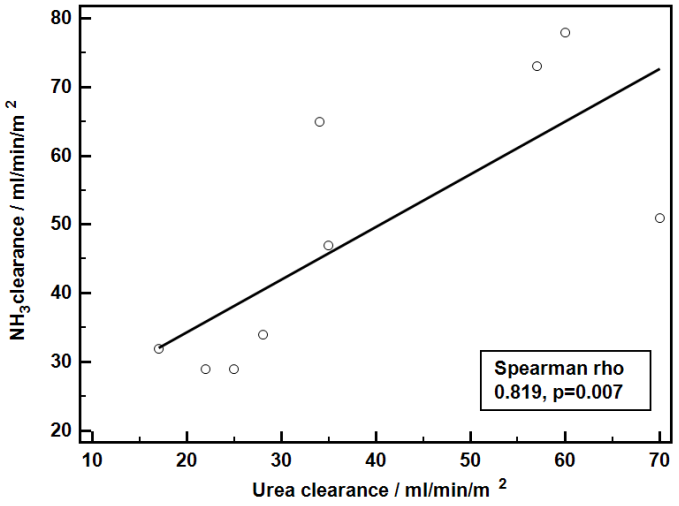
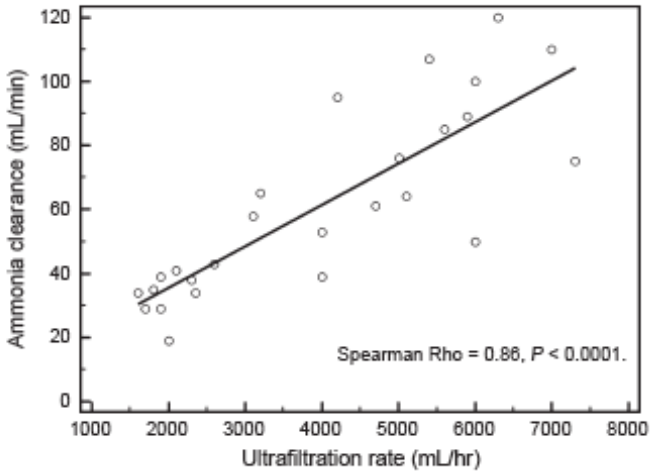


Figure: Interorgan trafficking of ammonia in health and in cirrhosis
In healthy individuals, liver removes ammonia by detoxification into urea. In patients with cirrhosis, metabolic capacity of liver is reduced, resulting in hyperammonaemia: muscle becomes important organ of ammonia detoxification into glutamine. Glutamine acts as temporary buffer that can both regenerate ammonia (enterocytes) and excrete ammonia (kidneys).

Liver International (2013)



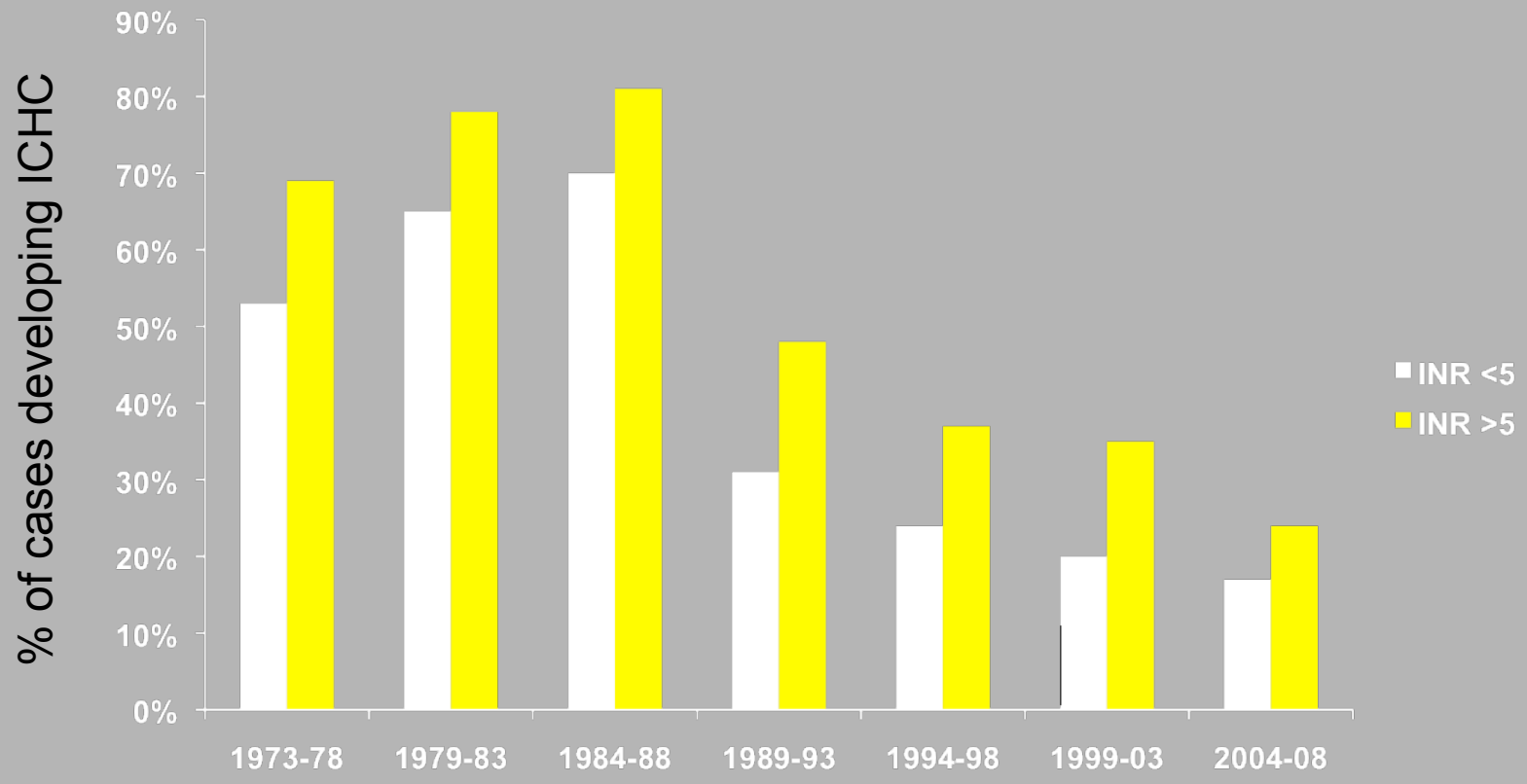


Indication for RRT

- Acidosis / Acidaemia
- Metabolic disarray : lactate
- Cl/Na control
- Ammonia clearance
- Hepatic encephalopathy

Journal of Hepatology 2013

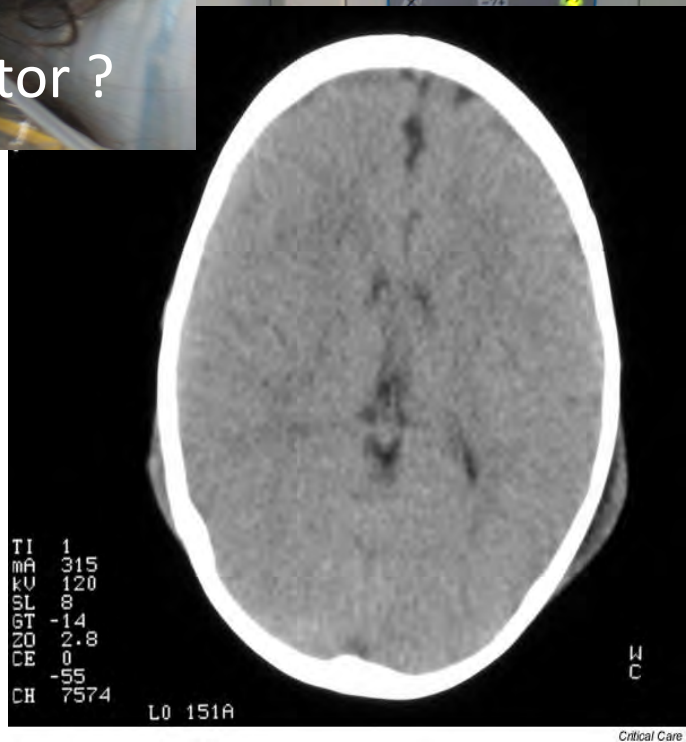
Clinical Evidence of Intra-cranial Hypertension. All Severe HE. Split by admission INR



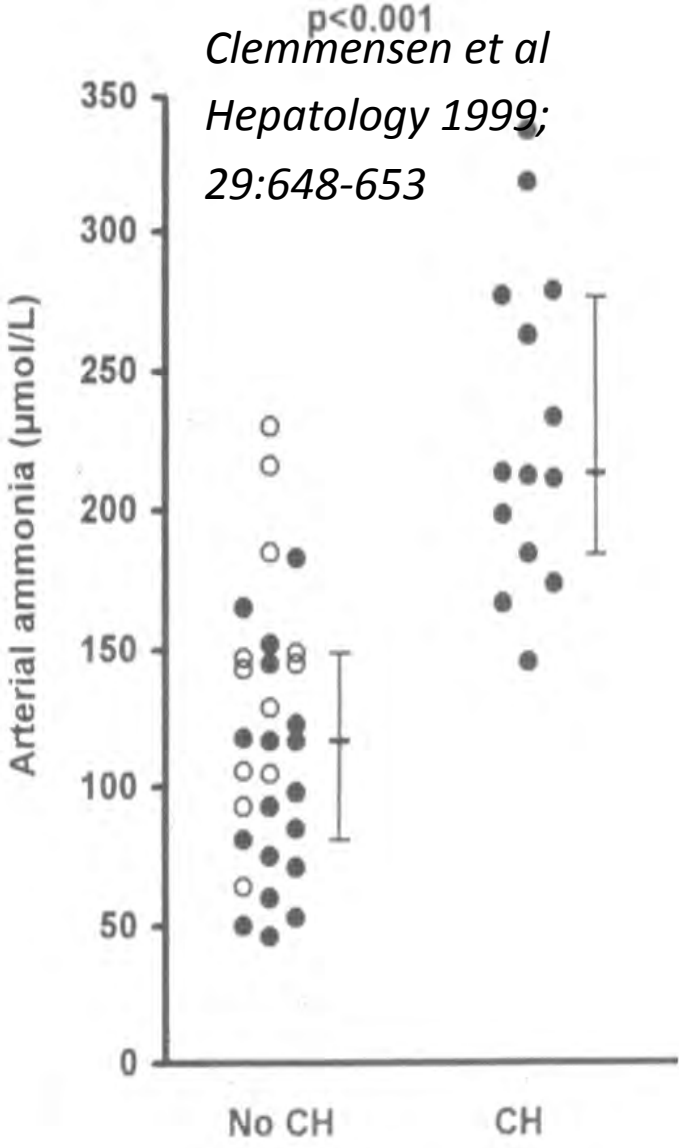
Grade III/IV coma
Young people
Haemodynamic instability
Fever, SIRS, low Na
Elevated NH4 (>150)
Renal failure
MCA dopplers

Bernal W Hepatology 2008

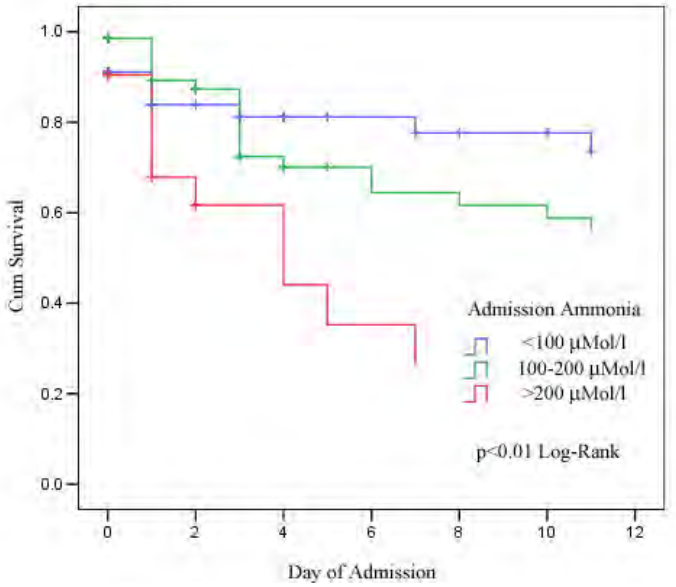
10% complication rate
5% significant
Vaquero Liver Transplantation Dec 2005



Clemmensen et al Hepatology 1999; 29:648-653



Bernal W Hepatology 2007



Journal of Cerebral Blood Flow & Metabolism (2006) 26, 21–27

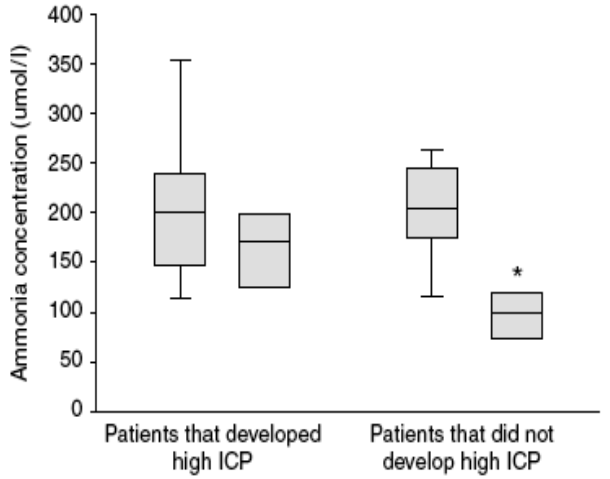


Figure 1 Arterial ammonia concentration (µmol/L) in two groups of patients with fulminant hepatic failure (FHF): patients who did develop high ICP and patients who did not. For each group, baseline values and values taken later during FHF are given. *$P < 0.05$ versus baseline values in both groups.

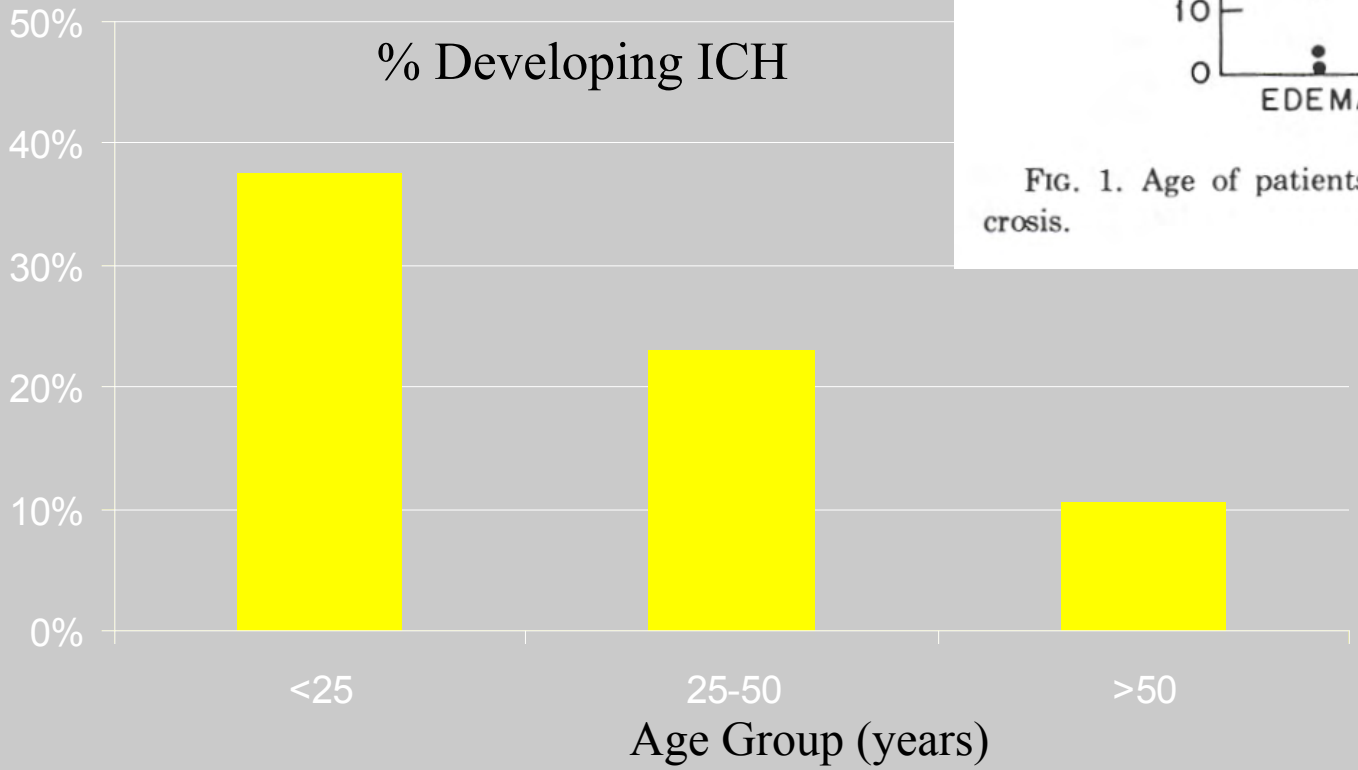
NH4 cut off 124 : pH, cerebral oedema + NH4 predict outcome

Bhatia V Gut 2005

ICH and Age

n=380
p<0.0002

All Patients



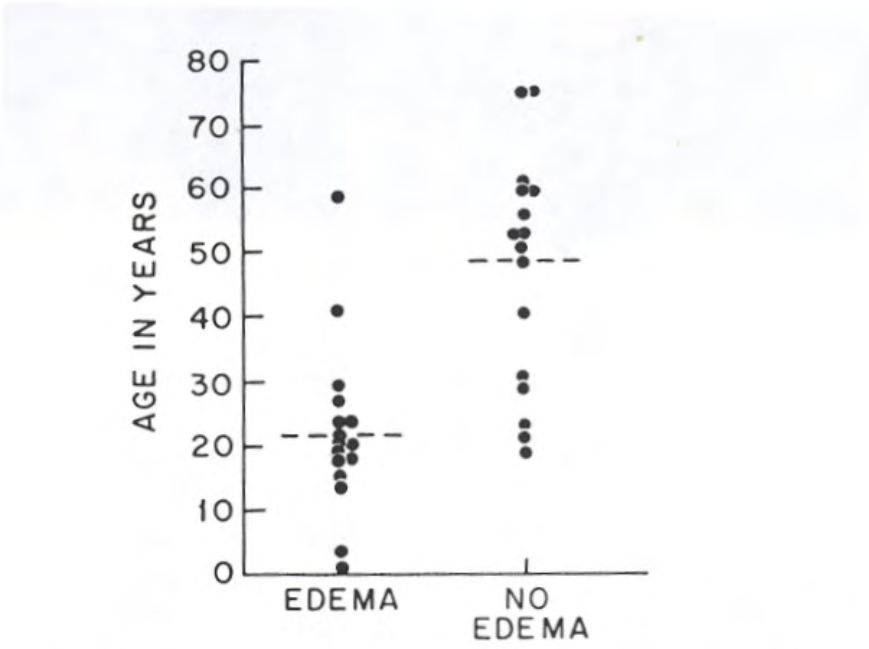


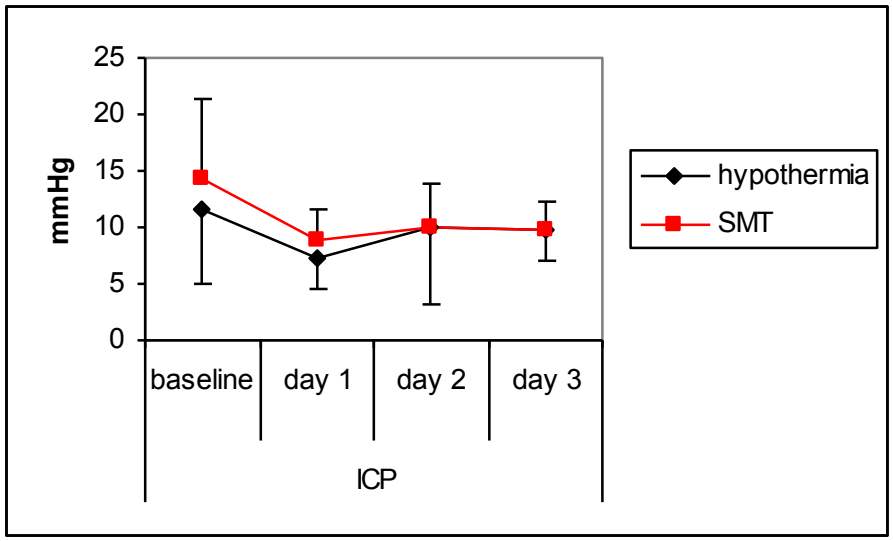
FIG. 1. Age of patients with massive hepatic necrosis.

Ware et al Gastroenterology 1971;61(6):877-84

ICP	45 (25-49)	16 (13-17) *
CBF	103 (25-134)	44 (24 -75) *
CPP	45 (37-56)	70 (60-78) *
CI	9.8 (7-13)	5.1 (4.3-6.1) *

•Art NH4 343 (109 - 490) to 259 (100-453)*
Restoration of autoregulation

Jalan et al Lancet 354: 9185 :1164 1999
Jalan et al Gastroenterology 2004;27:1338



Cerebral oedema is rare in acute-on-chronic liver failure patients presenting with high-grade hepatic encephalopathy. 2013

Deepak Joshi[1]

Liver International ISSN 1478-3223

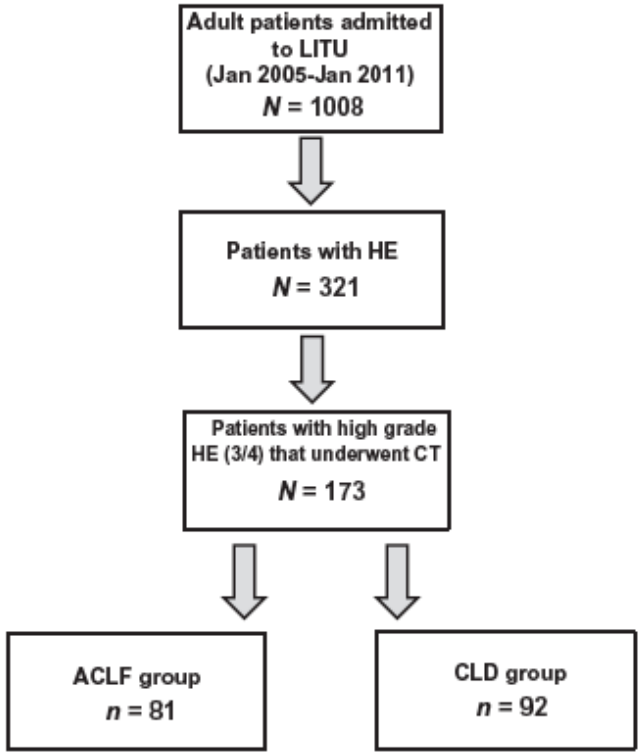


Table 1. Patient demographics and clinical parameters in whom neuroimaging was available

	ACLF (n = 81)	CLD (n = 92)	P-value
Age (years)	50 (24–71)	59 (30–74)	0.001
Sodium (mmol/L)	132 (118–154)	136 (120–146)	<0.0001
Creatinine (mmol/L)	96 (44–800)	96 (41–655)	0.63
Albumin (g/L)	25 (12–54)	28 (16–54)	0.001
Bilirubin (μmol/L)	137 (85–804)	45 (6–575)	0.001
White cell count ($\times 10^9$/L)	8.9 (2.52–76)	6.4 (0.99–61)	0.03
INR	1.7 (1.5–5)	1.4 (0.9–4.5)	<0.0001
Platelets ($\times 10^9$/L)	66 (15–280)	88 (19–454)	0.02
Fibrinogen (g/L)	1.9 (0.4–6.0)	3.1 (1.3–6.4)	0.007
Arterial ammonia (μmol/L)	143 (40–305)	111 (28–315)	<0.0001
Child–Pugh	12 (5–13)	7 (5–13)	<0.0001
MELD	25 (8–40)	15 (6–34)	<0.0001
SOFA	11 (2–17)	4 (0–14)	<0.0001
SIRS score	2 (1–3)	1 (0–3)	<0.0001

Table 2. Summary of CT findings between ACLF and CLD groups

	ACLF	CLD	*P*-value
Normal (*n*/%)	21/26	30/33	0.6
Increased cerebral atrophy for age (*n*/%)	21/26	30/33	0.6
Small vessel disease (*n*/%)	12/15	17/18	0.4
Intracerebral haemorrhage (*n*/%)	19/23	9/9	0.008
Cerebral oedema (*n*/%)	3/4	0/0	0.04
Other (*n*/%)	5/6	6/7	0.6

72 ALF in grade III/IV coma underwent CT imaging : incidence of radiological cerebral oedema was 32%

Table 3. Patient characteristics with ACLF and cerebral oedema on admission

Patient	Age (years)	Sex	Aetiology of cirrhosis	Precipitant of ACLF	Neurological abnormality	Sodium (mmol/L)	MELD	SOFA	HE grade	NH_3 (μmol/L)
1	50	Female	Cryptogenic	Variceal bleed, culture-negative sepsis, TIPS	Pupillary abnormality	134	38	8	4	289
2	52	Female	Alcohol	Culture negative sepsis	Seizure	132	19	8	4	268
3	66	Female	Alcohol	Alcoholic hepatitis, sepsis	Pupillary abnormality	137	21	9	4	238

- Agitation and airway management
  - Grade III : Intubate, ventilate and sedate with opiate and propofol
  - Control ventilation - avoid alkalosis
- Position - 10 to 20 degrees head up
- Insert reverse jugular line: JV sat 55 to 80%
- Control of glucose, K, pH, Na (145-150 mmol/L)
- Ammonia daily measurement: early CRRT; SIRS monitoring
- MAP > 60-65 : frequently not autoregulating - need to measure ICP
- No CPP aim per se
- Treat “ICP” - trigger > 25 or pupillary abnormalities
  - Hypertonic NaCl (30%) 20 ml Mannitol ; 150 ml 20% (osmolarity < 320)
  - Indomethacin 0.5 mg/kg (25-50 mg) only if JV(r) high
- Hyperventilation - only for ICP in association with high JV satn
- Temperature - avoid fever : hypothermia should not be undertaken routinely

FULMAR (Saliba et al)

- Prospective, controlled, randomized parallel group trial
  - Total number of patients: 102 (ITT)
  - Main etiology of ALF due to Acetaminophen (38%)
    - SMT = 19, MARS=20
- Comparison of SMT versus SMT + MARS

Indication

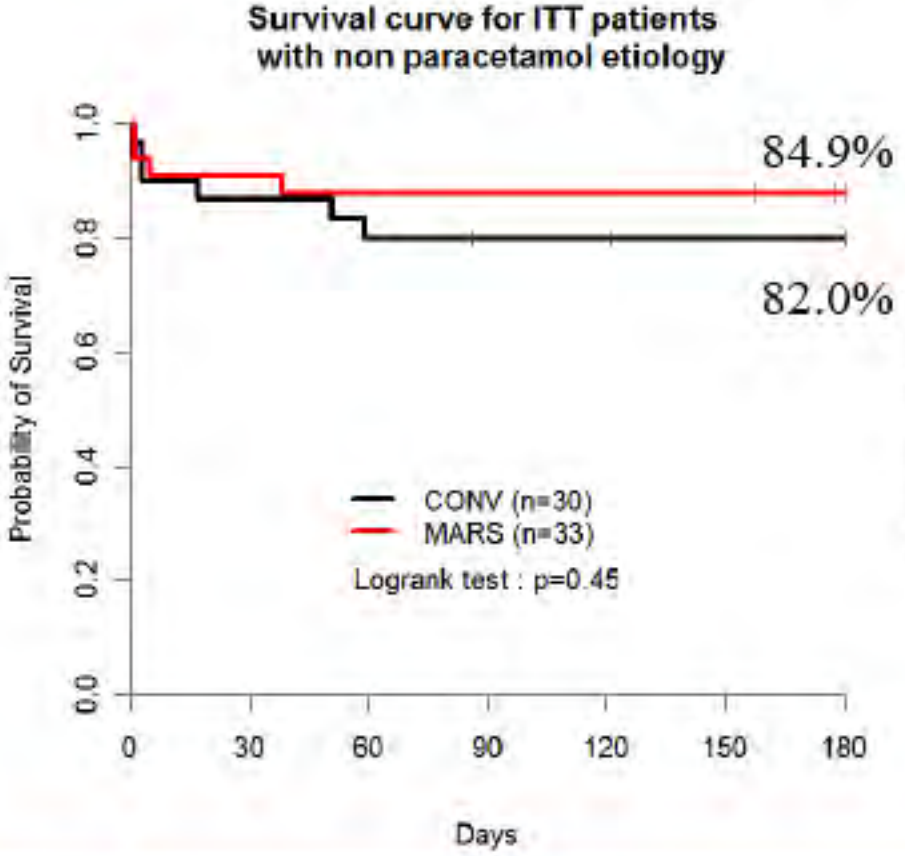
- ALF, with and without indication for liver transplantation
- 68/102 patients transplanted
  - 41% of acetaminophen group
- Median delay listing to transplant was 16.2 hrs

Faouzi Saliba et al , AASLD 2008.

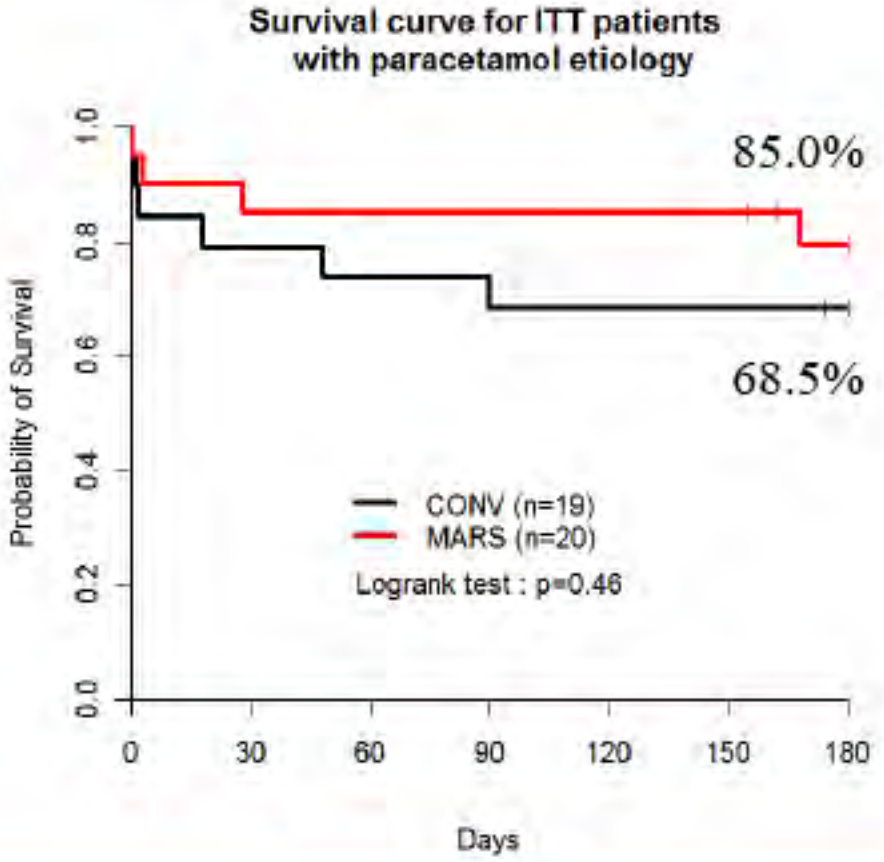
FULMAR Study

6 months patient survival / Etiology (ITT analysis)

Non Paracetamol



Paracetamol



GAMBRO

Courtesy: Faouzi Saliba et al., AASLD 2008, Gambro (Jason Turner)

Guidelines for referral

Paracetamol

Arterial pH < 7.30 or HC03 < 18

INR > 3.0 day 2 or > 4.0 thereafter

oliguria and/or elevated creatinine

altered conscious level

hypoglycaemia

Non-Paracetamol

pH < 7.30 or or HC03 < 18

INR >1.8

oliguria/renal failure

encephalopathy

hypoglycaemia

shrinking liver size

< 1000 ml need OLT

Na < 130 mmol/L

Bilirubin > 300 µmol/l

Children - coagulopathy

Budd Chiari

Pregnancy related

ALF and Tx as an option: if poor prognostic criteria achieved

Yes

Drug related
Acute Viral hepatitis
Toxins
Hepatic vein occlusion

Consider but very rarely required

Pregnancy related
Trauma

No

Ischemic hepatitis (HH)
Systemic Disease
- HLH
- Metabolic disease

Infiltrative Disease
Lymphoma

Exceptions to rules

Acute Wilsons disease
Children and young adults
Intercurrent viral illness
Stopped drugs
Coagulopathy, haemolysis & low AlKP04

	Edinburgh 1992-2009	Birmingham 1992-2008	ALFSG 1998-2001
N with ALF	515	1237	308
Listed for LTX	154 (30%)	327 (26%)	135 (44%)
Actually transplanted	117 (76%) (23% of all n)	263 (80%) (21% of all n)	89 (66%) (29% of all n)
Listed but no LTX Mortality in %	37 97%	64 77%	
No LTx	398 (77%)	974 (79%)	219 (71%)
Survived wout LTX	61%	74%	43%
Overall mortality of ALF	23-38% at 1 year		

Bretherick AD et al. Q J Med 2011; Marudanayagam R etal: HPB 2009, Ostapowicz G et al: Ann Internal Med 2002

Paracetamol/ Hyperacute

pH < 7.30

all 3 of the following within 24 hrs

PT > 100 INR > 6.5
Creatinine > 300 µmol/l
grade 3 - 4 encephalopathy

Lactate : 4 hrs > 3.5 OR 43 p<0.001

Lactate : 12 hrs > 3.5 OR 63 p<0.001

Budd Chiari : renal failure + HE

Clichy Criteria -Grade III +
Factor V <30% + age > 30
Factor V < 20% + age < 30

Non-Paracetamol

Time from Ingestion !!

pH < 7.3

INR > 6.5

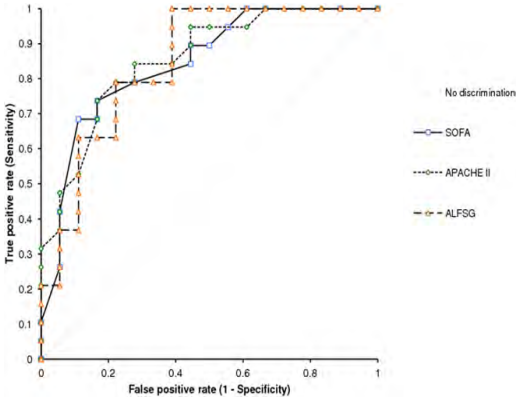
any 3 of :

seronegative hepatitis or drug related / halothane
Bilirubin > 300 µmol/l
INR > 3.5
Age < 10 yrs or > 40 yrs
J - E > 7 days

Low P04 : good prognosis
(Alpha feta protein)
MELD > 30
BiLE score
Liver volume and Bx

Acute liver failure:
Prognostication based on scores or biomarkers

King's College criteria : paracetamol and non-paracetamol ± lactate



Clichy criteria

MELD > 30

Gc-globulin, alpha-fetoprotein

BiLE criteria (bilirubin, aetiology, lactate)

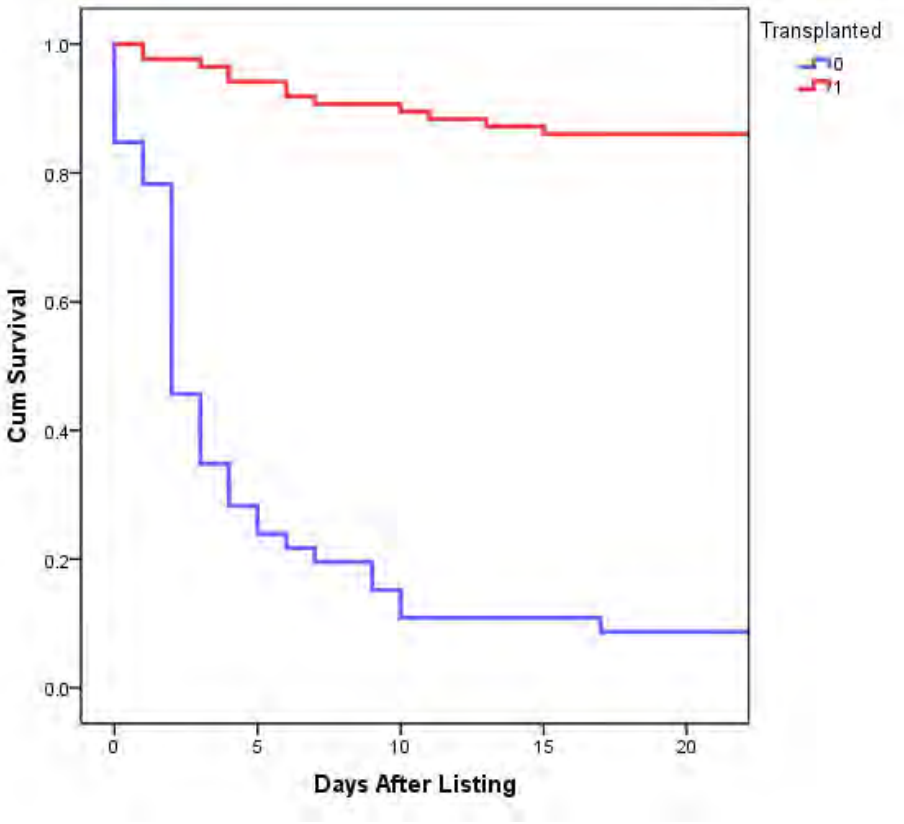
USA ALF index

Liver volume, liver % necrosis on Bx

Wilsons index

Use of prognostic models

- Critical to minimise ‘unnecessary transplantation’



Kings College Hospital 1994-2004. n=136

Bernal et al 2007 J Hepatology

Meta-analysis of performance of Kings's College Hospital Criteria in prediction of outcome in non-paracetamol-induced acute liver failure

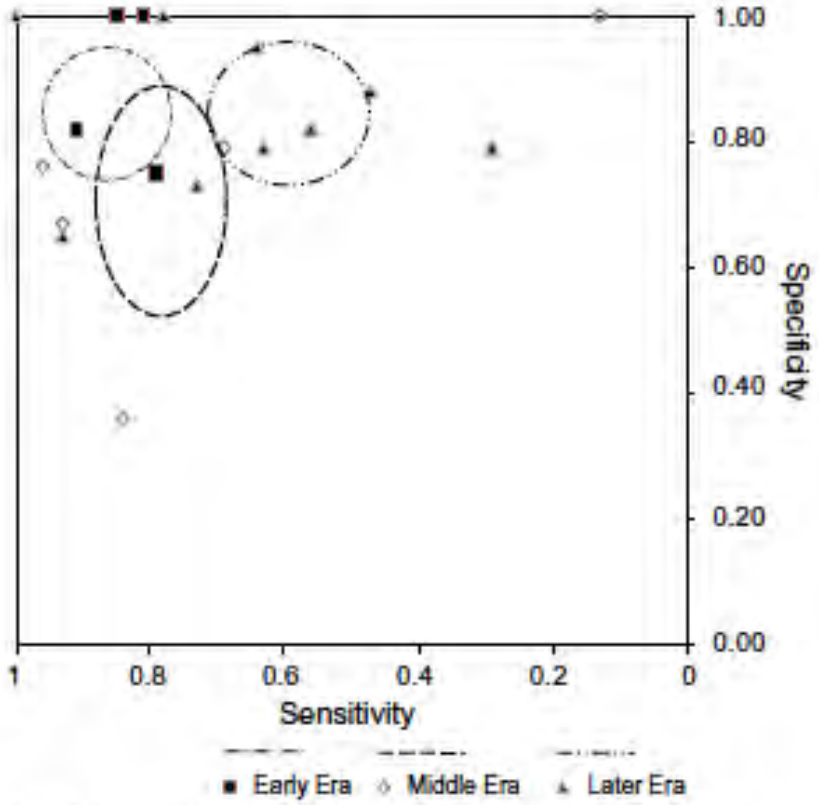


Fig. 4. Sensitivity/specificity plot showing changes in predictive behaviour in KCC for early (pre 1995), middle (1996–2005) and later (post 2005) eras demonstrating reduction in sensitivity with era with preservation of specificity. Ellipses subtend the 95% CI for sensitivity and specificity for each era.

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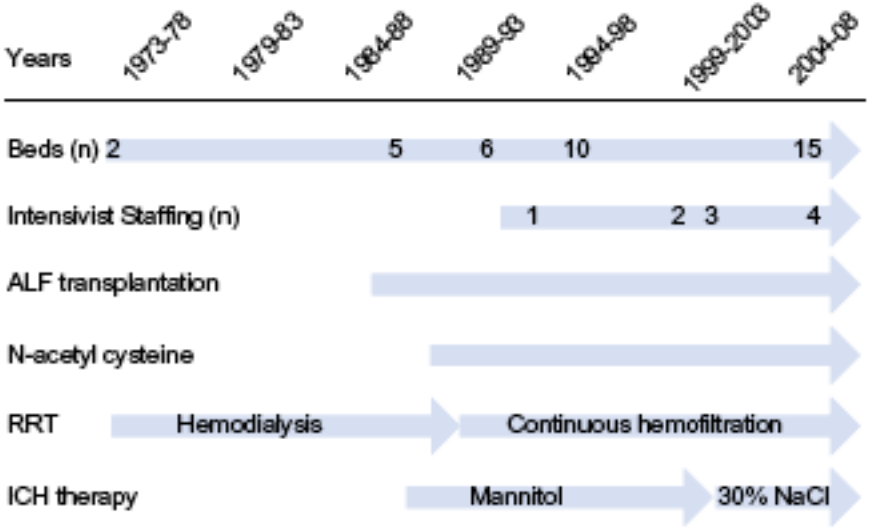


Journal of Hepatology **2013**

Lessons from look-back in acute liver failure? A single centre experience of 3300 patients

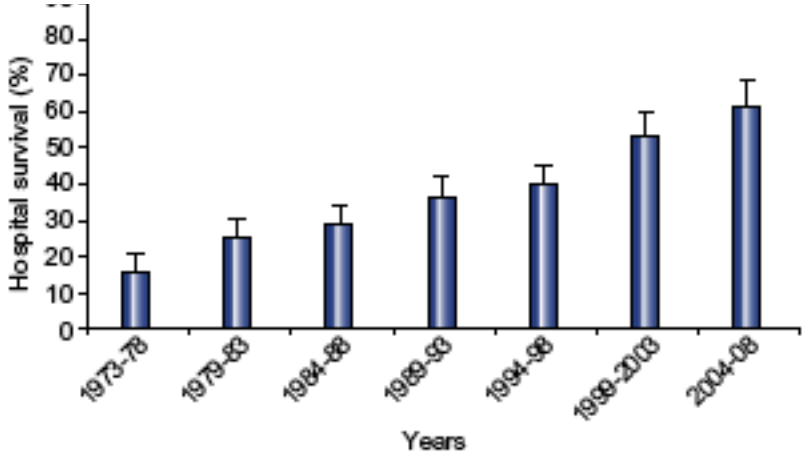
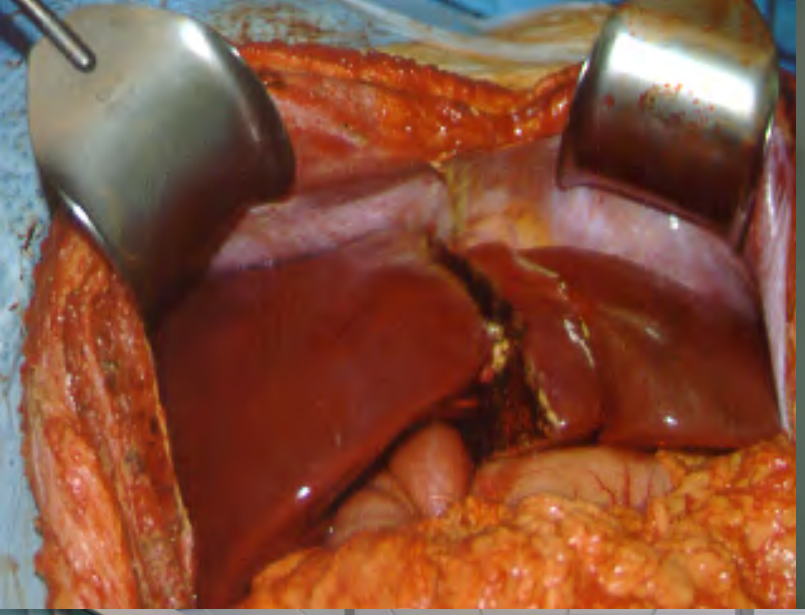
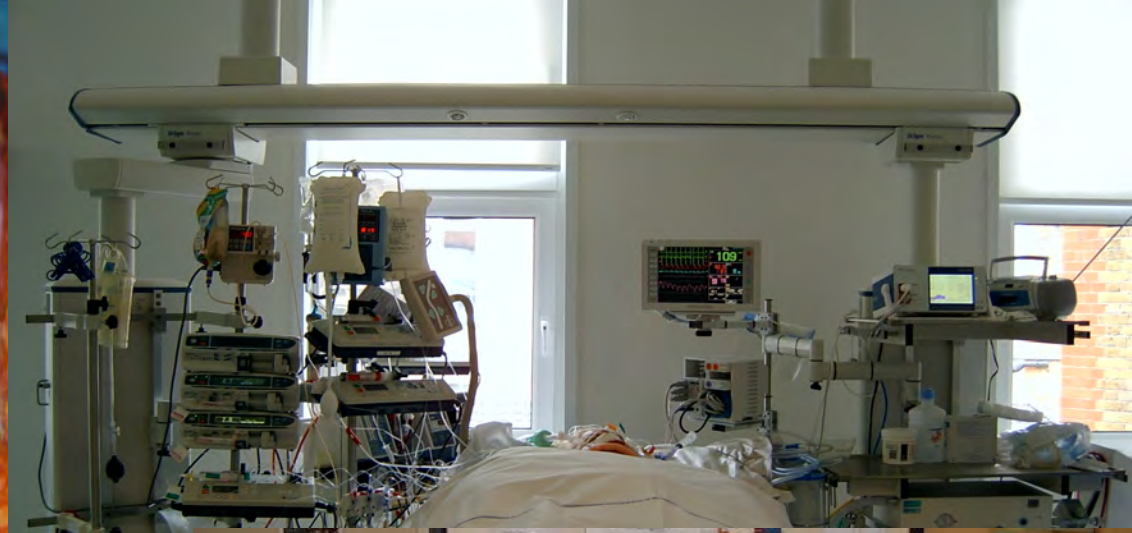
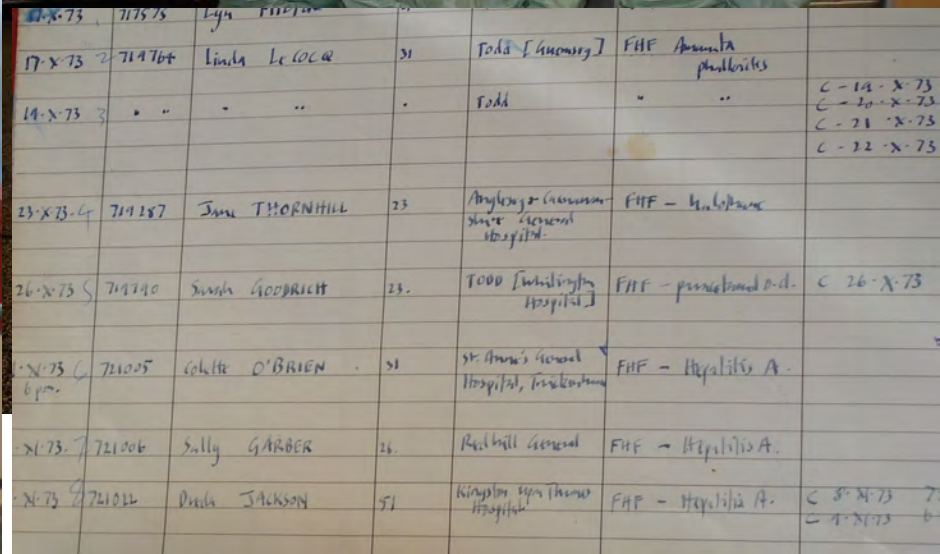


Fig. 3. Hospital survival in 2095 admissions with ALF by era. Error bars are 95% CI; $p < 0.00001$.







17·X·73	2	719764	Linda LeCOCQ	31	Todd [Guernsey]	FHF Amanita phalloides
19·X·73	3	"	"	"	Todd	" "
23·X·73	4	719287	Jane THORNHILL	23	Anglesey [Caernarvon and Denbigh General Hospital]	FHF – Halothane
26·X·73	5	719790	Sarah GOODRICH	23.	TODD [Huntingdon Hospital]	FHF – paracetamol O.D.
·X·73	6	721005	Colette O'BRIEN	31	St. Anne's General Hospital, Tricktown	FHF – Hepatitis A.
·X·73	7	721006	Sally GARBER	26.	Redhill General	FHF – Hepatitis A.
·X·73	8	721022	Paula JACKSON	51	Kingston upon Thames Hospital	FHF – Hepatitis A.

C – 19 · X · 73
C – 20 · X · 73
C – 21 · X · 73
C – 22 · X · 73
C 26 · X · 73
C 5 · X · 73

Teams make things work

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Infection is common in ALF & related to severity

Karvellas Intensive Care Med 2009

Variable	NBACIf (%)	BACIf (%)	*P* value
	$n = 134$ (65)	$n = 72$ (35)	
Median age	38 (28–48)	39 (27–47)	0.78
Sex (males)	56/134 (42)	31/72 (43)	0.98
On admission			
Respiratory rate	20 (16–26)	18 (15–24)	0.13
Temperature (°C)	36.2 (1.4)	35.8 (1.1)	0.44
MAP (mmHg)	67 (58–80)	67 (59–79)	0.85
Heart rate	108 (80–122)	107 (95–126)	0.49
On vasopressors	46/134 (34)	22/72 (31)	
White blood count	10.0 (6.1–13.9)	9.9 (5.1–14.1)	0.80
SIRS score	1.0 (		
SIRS score ≥2	54/1		
PO_2/FiO_2 ratio	287		
INR	3.2 (		
Creatinine (mmol/l)	150		
Bilirubin (mmol/l)	87 (		
Lactate (mmol/l)	3.6 (		
Ammonia (μmol/l)	103		
pH	7.4 (7.4		
APACHEII	17.6		
Glasgow coma score	8 (6-		
During total LITU stay			
RRT in LITU	87/1		
Days on RRT	3 (0-		
MV in LITU	103/		
Days on MV	5 (2-		
Maximum HE grade >2	84/1		
Length of LITU stay	7 (3–13)	26 (18–36)	**<0.001**
KCH criteria[a]	69/134 (51)	39/72 (54)	0.83
Listed for transplant	41/134 (31)	27/72 (36)	0.40
Transplanted	33/134 (26)	26/72 (36)	**0.08**
Survival[b]	86/134 (64)	45/72 (62.5)	0.93

Table 2 Logistic regression model predicting mortality in all ALF patients (using APACHEII to adjust for illness severity)

Predictor	Odds ratio	Standard error	95% CI	*P* value
Liver transplant	0.20	0.09	0.08–0.49	<0.0001
APACHEII	1.09	0.03	1.04–1.14	<0.0001
Age	1.41	0.20	1.06–1.86	0.02
Lactate	1.14	0.06	1.03–1.26	0.006
Maximum HE grade	1.76	0.37	1.16–2.67	0.007

Odds ratios are expressed for APACHEII (incremental units), lactate (per 1 mmol/L). Odds ratio per 10-year deviation from the mean age 37.8 years. Maximum hepatic encephalopathy (HE) grade pre-intubation

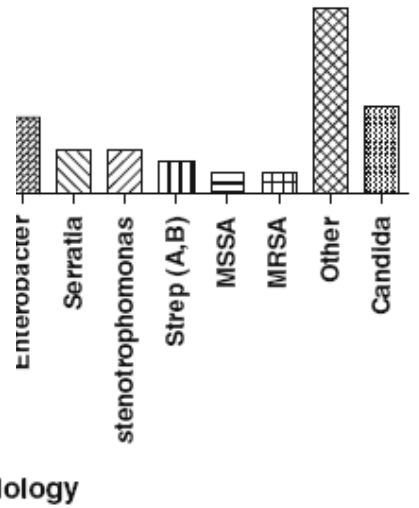

Fig. 2 Frequency of bacteraemia/fungaemia isolates in 72 ALF patients admitted to the Liver intensive therapy unit at King's College (January 2003–July 2005)