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Validation of Early Dynamic Model (EDM) in Predicting the Outcome of Acute Liver Failure (ALF) in a Cohort of Kashmiri Population: A Prospective Study

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Introduction

Acute liver failure is used to describe the development of coagulopathy, usually with an international normalized ratio (INR) of greater than 1.5, and any degree of encephalopathy in a patient without preexisting cirrhosis and with an illness of less than 26 weeks duration. Overall incidence of ALF is 1 - 6 cases per million people every year. ALF accounts for up to 7% of all liver-related deaths [4] and is responsible for 6% of liver transplants.(1-6)

O'Grady *et al.*(7-10) classified ALF into hyper acute, acute, and sub-acute liver failure on the basis of encephalopathy less than 7, 8–28, and more than 28 days but less than 26 weeks, respectively, from the onset of jaundice.

The main etiological factor includes:

Viral - which mostly include hepatotropic (HBV, HAV, HEV, HCV, HDV, HGV) and non-hepatotropic (CMV, HSV, EBV etc.). Viral hepatitis is the commonest cause of acute liver failure world-wide and in the Indian subcontinent alone it accounts for 90% of cases.(11-14)

Drug related hepatotoxicity accounts for more than 50% of acute liver failure cases, including acetaminophen toxicity (42%) and idiosyncratic drug reactions (12%)(15-20)

Other causes include

- Autoimmune hepatitis
- Toxin- Amanita phalloides mushroom toxin.
- Vascular causes- Ischemic hepatitis, Hepatic vein thrombosis (Budd-Chiari syndrome), Hepatic veno-occlusive disease, Portal vein thrombosis, Hepati arterial thrombosis.
- Metabolic causes- Alpha1-antitrypsin deficiency, Fructose intolerance, Galactosemia, Lecithin-cholesterol acyltransferase deficiency, Reye syndrome, Tyrosinemia, Wilson disease.

- Malignancies - Primary liver tumor (usually hepatocellular carcinoma, rarely cholangiocarcinoma), Secondary tumor (extensive hepatic metastases or infiltration from adenocarcinoma, such as breast, lung, melanoma primaries [common]; lymphoma; leukemia).[21]
- Indeterminate - associated with especially poor survival with medical therapy alone, and frequently need emergency transplantation.[22, 23]

Management of ALF

The management of patients with ALF primarily requires to deal with the complications that may include renal failure, circulatory dysfunction, coagulopathy, gastrointestinal bleeding, encephalopathy, cerebral edema and metabolic disturbances like metabolic acidosis and hypoglycemia.[24] Despite Advances in critical care one of every three patients with ALF dies. Mortality can be attributed to three complications in particular: cerebral edema, multiorgan dysfunction syndrome, and sepsis.

Patients with ALF attributed to acetaminophen have spontaneous recovery rates that approximate 60% (and may be as high as 80% in those who receive timely therapy and excellent supportive care), whereas those with autoimmune, drug-induced (non-acetaminophen) ALF or with ALF of indeterminate cause fare less favorably, with spontaneous resolution occurring in around 25%.

While many people who develop acute liver failure recover with supportive treatment, liver transplantation is often required in people who continue to deteriorate or have adverse prognostic factors.

Orthotopic liver transplantation remains the only definitive therapy for patients who are unable to achieve regeneration of sufficient hepatocyte mass to sustain life. Currently, the advance of transplantation has coincided with further improvement in overall survival rates to over 60%.[10]

Several prognostic scoring systems have been devised to predict mortality and to identify who will require early liver transplant. These include King's College Hospital criteria, MELD score, APACHE II, and Clichy criteria.

The King's College Criteria (table 1) remained the most clinically useful, with a sensitivity of 68%-69% and specificity of 82%-92%.[29]

Table 1: King College Hospital Criteria for liver transplantation in ALF[30]

Acetaminophen related ALF
Arterial pH <7.3 (regardless of encephalopathy grade)
OR
Grade III or IV encephalopathy and
Prothrombin time >100s and
Serum creatinine >3.4mg/dl
All other causes of ALF (NAI-ALF)
Prothrombin time >100s (INR>6.5) regarless of encephalopathy grade)
OR
Any three of the following variables(regardless of encephalopathy grade)
1.Age <10 yr or >40 yrs.
2.etiology :non- A,non-B hepatitis, halothanehepatitis; idiosyncratic drug reaction
3.duration of jaundice before onset of encephalopathy>7 days
4.Prothrombin time >50s(INR>3.5)
5.serum bilirubin>17.5mg/Dl

MELD score and modified MELD score

MELD score:

The MELD score was initially developed to esti mate 3month mortality risk in patients with hepa tic cirrhosis treated with transjugularintrahepatic portosystemic shunt procedure.[31]

It is based on a composite of three available obje ctive biochemical variables including serum bilir ubin, creatinine and international normalized rati o.

[MELD score=9.57×ln creatinine (mg/dl)+3.78×l n bilirubin (mg/dl)+11.2×ln INR+6.43],

The MELD score has been extensively applied and validated in patients with end-stage liver disease of diverse etiology and severity.[30,31]

Recently, the MELD score has been used in the assessment of the Mortality in patients with ALF.[32,33]

Some evidences show that the MELD score is superior to the KCH criteria to assess prognosis in patients with ALF.

Modified MELD score

Several studies have shown that the predictive value of the MELD score is increased by adding clinical or laboratory variables. Serum sodium which is readily available, is recently considered as a useful predictor of mortality in patients with end-stage liver disease, and may improve the accuracy if added to the MELD score.

Some reports have suggested that the incorporati on of sodium into the MELD, called MELDNa, can predict a more accurate survival than theME LD alone. [34,35]

Clichy Criteria[36]

Based on a French prospective study of patients presenting with acute viral hepatitis, in which patients identified as having the lowest survival without liver transplantation included those with hepatic encephalopathy and low factor V levels. Presence of hepatic encephalopathy and factor V level:

- <20% of normal in patients <30 years of age, or
- <30% of normal in patients >30 years of age.

Acute Physiology and Chronic Health Evaluation (APACHE) II

The APACHE II scoring system was developed to predict mortality in patients of all disease categories admitted to intensive care units. The score comprises 12 common physiologicaland laboratory parameters, adjusted for patient age and underlying chronic health problems. One prospective study in patients with paracetamol (acetaminophen) overdose found that an APACHE II score >15 was associated with high mortality and provided similar predictive value to the King's College Criteria, while another study found a score of ≥20 to be more predictive of mortality and need for liver transplant.

Importance of Acute Liver Failure Early Dynamic (ALFED) Model in predicting outcome of Acute liver failure

The prognostic models used to predict mortality in ALF should therefore be robust in order to select appropriate candidates for LT and to prevent avoidable LT. Furthermore, the results of urgent LT in ALF continue to be inferior to non- urgent LT. Unfortunately, none of these models has consistently demonstrated a reliable accuracy in predicting outcome. In general, these prognostic markers have high specificity but unacceptably low sensitivity.[36-39]

ALF is a dynamic process where variables determining prognosis at admission change over time, and thus the clinical course varies accordingly. Serial measurement of predictive variables may therefore be more informative in following the clinical course in such patients. A study on acetaminophen-induced ALF showed that patients with a continuing deterioration in prothrombin time between days 3 and 4 after overdose had a higher mortality than patients in whom the prothrombin time improved (93% vs. 22%). It therefore seems logical that evaluating serial changes in the predictive variables can predict outcome better than using baseline variables.

Acute liver failure EARLY DYNAMIC MODEL takes into consideration the dynamic variables of Acute liver failure taken on the day of admission, second day and third day of admission .It depends on four dynamic variables which include bilirubin, INR, hepatic encephalopathy, arterial ammonia levels taken on first three consecutive days and an ALFED score is calculated on day three, which classifies patients into low risk , moderate risk and high risk.

Patients with high risk need urgent liver transplantation and should be referred to liver transplantation centre, and those with low risk have very low mortality, maximum of which can be managed conservatively without liver transplantation.

Material and Methods

Forty patients with the diagnosis of acute liver failure (ALF) were recruited in this study in a prospective manner. ALF was defined as the rapid development of acute liver injury with impaired synthetic function (biochemical evidence suggested by INR >1.5) and any degree of encephalopathy in a person who previously had a normal liver(illness of duration <8 weeks).

Primary goal of this study was to validate ACUTE LIVER FAILURE EARLY DYNAMIC MODEL (ALFED) in our patient population and select patients who can be managed conservatively without liver transplantation and to compare ALFED with Kings College criteria and MELD score in same population.

At the time of admission, complete history, physical examination including the Grade of encephalopathy, liver span, ascites were assessed. Detailed history of any hepatotoxic drug intake, including homeopathic, herbal medications was taken. Blood samples of all the patients were taken for the etiological diagnosis of ALF which included HBsAg, hepatitis B core IgM (HBc-IgM), hepatitis A virus IgM (HAVIgM) and hepatitis E virus IgM (HEV-IgM), anti HCV (hepatitis C virus), ANA (antinuclear antibodies), ASMA(anti smooth mulscle antibody),Wilsons profile (serum ceruloplasmin, serum copper) and iron profile. HSV (herpes simplex virus), CMV (cytomegalovirus) and EBV (Epstein barr virus) were done if non hepatotropic viruses were suspected as a cause of ALF..

Arterial ammonia levels were done on day 1 and day 3. Arterial ammonia level was determined by semiautomatic photometric systems. Wave length used was 340nm, 380nm. Reference Range (µmol/L) Adults = 12-47

ALFED depends on four variables (predictors of mortality at admission).

Variables at admission DAY 1	score assigned
1 Advanced hepatic encephalopathy (HE)>2	1
2 INR ≥ 5	1
3 Arterial ammonia ≥123micro moles/ltre	1
4 Serum bilirubin ≥15mg/dl	1

Since ALF is a dynamic process, dynamicity of variables over three days is assessed.

Predictors of mortality based on variables of dynamicity of ALF over three days.

Variables on day 3	score assigned
1 persistent or progressed to grade 2	2
2 INR persistent or ≥ 5	1
3 Arterial ammonia persistent or ≥ 123 micromoles/ltr	2
4 Serum bilirubin persistent or ≥ 15 mg/dl	1

On the basis of ALFED score patients were stratified into low, moderate and high risk.

Risk Groups	Total Score On Day 3
Low Risk	0-1
Moderate Risk	2-3
High Risk	4-6

Continuous variables were analysed by using students two sample independent t-test. categorical variables were analysed by using Pearsons chi square test, Fishers exact test. P value <0.05 were considered to be statistically significant.

Observations and Results

Out of total 40 patients recruited in this study, Males constituted 47.5 % and females constituted 52.5 % of total patient population. Acute liver failure patients had a mortality of 65 % (n=26). The mean age of all patients of ALF was 28.31, in which mean age of survived was 28.36 and mean age of died patients was 28.27 yrs. as shown in table 2, 3 and fig.1, 2.

Table 2

	Outcome	No. of patients	Mean±SD
Mean age	Survived	14	28.36±15.66
	Died	26	28.27±16.99

P value =0.088, P value <0.05 is considered significant.

Table 3

Gender	Outcome		Total n(%)
	Survived n (%)	Died n(%)	
Males	7(50)	12(46.2)	19(47.5)
Females	7 (50)	14(53.8)	21(52.5)

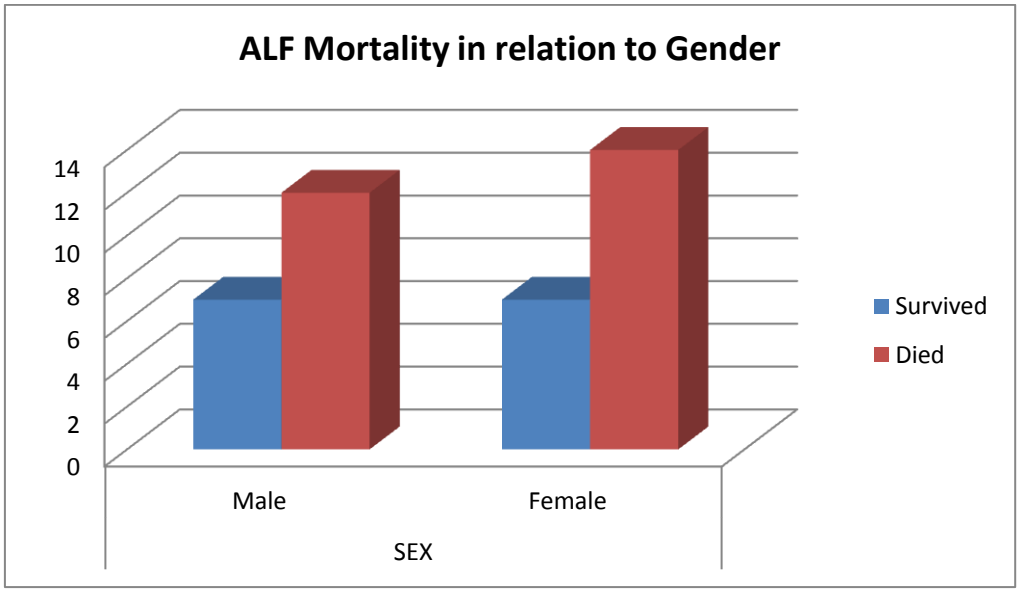

Figure 2

Etiology and outcome of ALF in our study population is depicted in Table 4 and Fig 3,4.

The most common cause of ALF was undetermined followed by Drug induced liver injury, Hep.A, Hep.B, Hep. E ,Acute fatty liver of pregnancy followed by Wilsons Disease.

The overall mortality of ALF was 65% in our cohort with undetermined group having maximum mortality

Table 4

Etiology	Outcome		Total n (%)
	Survived n(%)	Died n(%)	
Undetermined	3(21.4)	9(34.6)	12(30)
DILI	5(35.5)	4(15.5)	9(22.5)
Hep.A	1(7.1)	5(19.2)	6 (15)
Hep.B	2(14.2)	3(11.5)	5(12.5)
Hep.E	1(7.1)	3(11.5)	4(10)
AFLP	1(7.1)	2(7.7)	3(7.5)
Wilsons	1(7.1)	0(0)	1(2.5)

Parsons chi square =5.324, P value=0.621

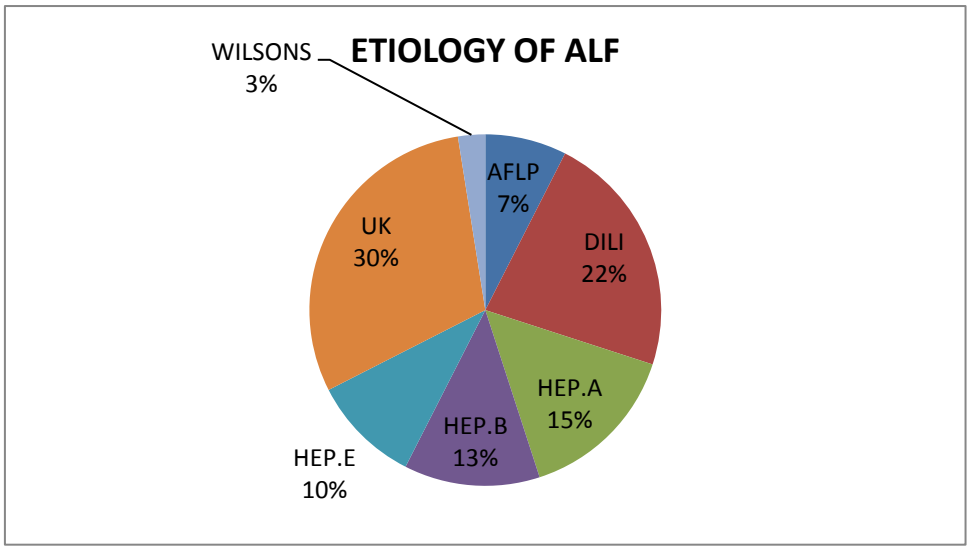

Figure 3

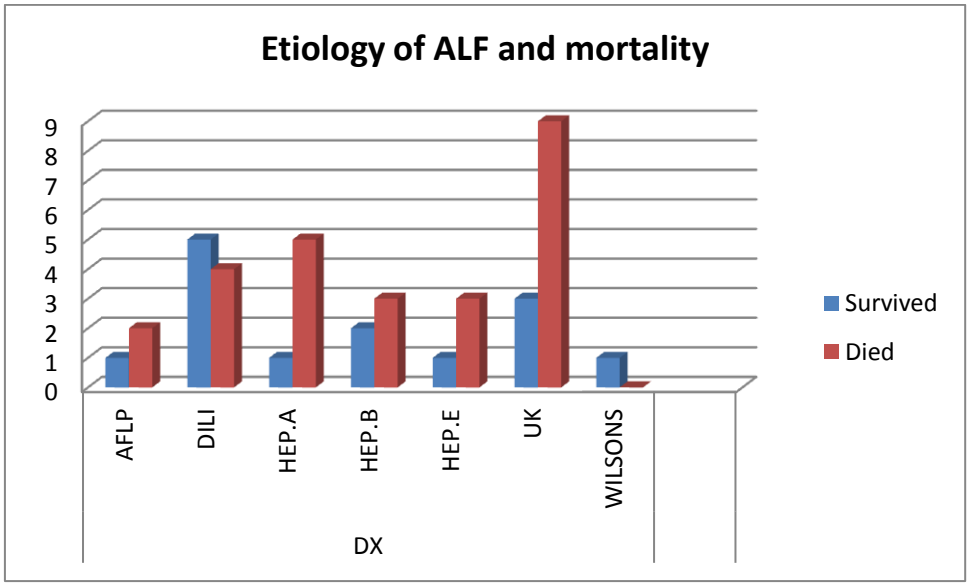

Figure 4

At the time of admission 62.5% patients had grade I-II encephalopathy while as grade III-IV encephalopathy was seen in 37.5% of patients.) With mortality rate of 52% and 86.6% in the two groups respectively as shown in table 5 and fig.5.

Table 5

Grade of Encephalopathy	Outcome		Total n(%)
	Survived n(%)	Died n(%)	
I –II	12(85.7)	13(50)	25(62.5)
III –IV	2(14.3)	13(50)	15(37.5)

Fishers exact test=0.040; p value <0.05 is considered significant.

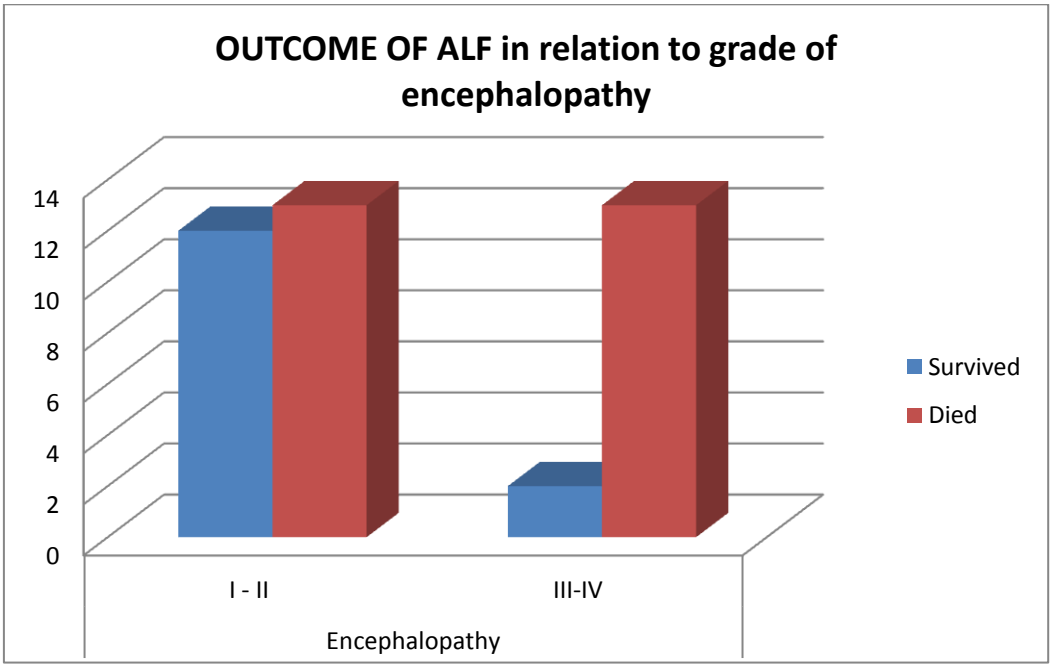

Figure 5

All patients with nil liver span died while as only 63 % (n=12) patients with decreased liver span died. Only 36% (n=4) patients with normal liver span on admission died as shown in table 6,fig.6

Table 6

Liver span	Outcome		Total n(%)
	Survived n(%)	Died (%)	
Normal	7(50)	4(15.4)	11(27.5)
Decreased	7(50)	12(46.2)	19(47.5)
Nil	0(0)	10(38.5)	10(25)

Parsons chi square =9.378, P value=0.009,

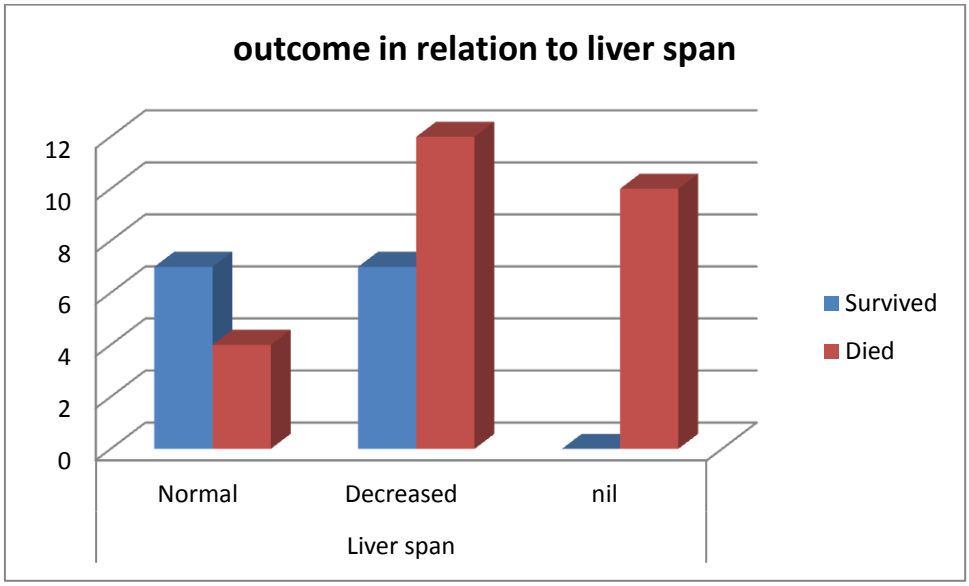

Figure 6

Patients with ascites had mortality rate of 90% whereas ALF patients without ascites had a low mortality of 36.8% as shown in table 7.

Table 7

Ascites	Outcome		Total n(%)
	Survived n(%)	Died (%)	
Absent	12(85.7)	7(26.9)	19(47.5)
Present	2(14.3)	19(73.1)	21(52.5)

Fishers exact test=0.001.

We applied KCH, MELD and ALFED Score on day 1and day 3 to all our patients. KCH score on day of admission, classified 21 patients as high risk with need for liver transplantation. Out of them only 76 % (n=16) died, while as 24% (n=5) survived without liver transplantation. conversly KCH classified 19 patients as low risk, out of them only 47% (n=9) survived, while as 53% (n=10) died (table 8, fig.7).

Table 8

KCH score on day 1	Outcome		Total n(%)
	Survived n(%)	Died n (%)	
1	3(21.4)	1(3.8)	4(10)
2	6(42.9)	9(34.6)	15(37.5)
3	5(35.7)	13(50)	18(45)
4	0(0.0)	3(11.5)	3(7.5)

Parsons chi square =5.006, P value =0.171

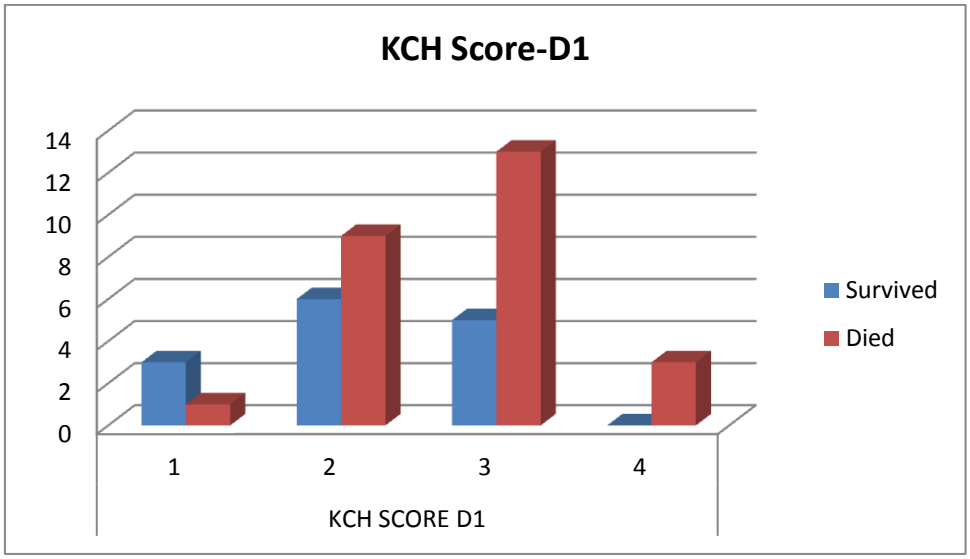

Figure 7

On the day of admission, ALFED classified patients into 5 classes[0-4] with mortality rates of 40% for score 0, 55.5% for score 1, 75% for score of 2 and 3,while as 50% for score 4.while as score on day 3 shows the dynamicity of model whether increasing or decreasing(table 9,fig.8)

ALFED on day 3 classified patients into 7 classes [0-6], with mortality of 0% for scores 0, 1, 2 .40% for score of 3 and 100% for score of 4, 5, and 6 with P value <0.0001 which is highly significant (table 10, fig.9). Hence ALFED Risk group shows highest mortality of 92.3% for high risk, 7.7% for moderate risk and 0% for low risk (table 11,fig.10).

Table 9

ALFED Day 1	OUTCOME		TOTAL n(%)
	Survived n(%)	Died n(%)	
0	3(21.4)	2(7.7)	5(12.5)
1	4(28.6)	5(19.2)	9(22.5)
2	4(28.6)	12(46.2)	16(40.0)
3	2(14.3)	6(23.1)	8(20.0)
4	1(7.1)	1 (3.8)	2(5.0)

Parsons chi square =2.979,P value =0.561

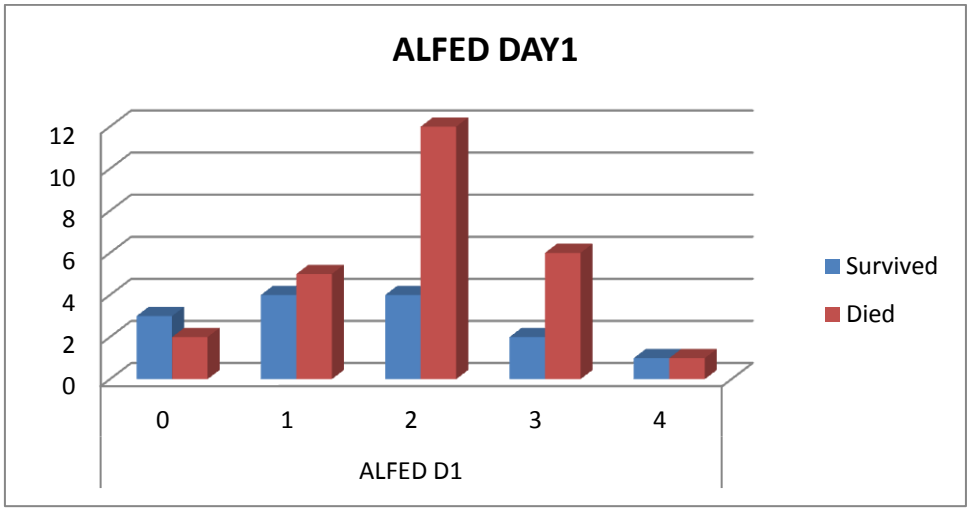

Figure 8

Table 10

ALFED DAY 3	OUTCOME		TOTAL n(%)
	Survived n(%)	Died n(%)	
0	4(28.6)	0(0.0)	4(10)
1	4(28.6)	0(0.0)	4(10)
2	3(21.4)	0(0.0)	3(7.5)
3	3(21.4)	2(7.7)	5(12.5)
4	0(0.0)	7(26.9)	7(17.5)
5	0(0.0)	12(46.2)	12(30)
6	0(0.0)	5(19.2)	5(12.5)

Parsons chi square =34.725, P value ≤0.0001

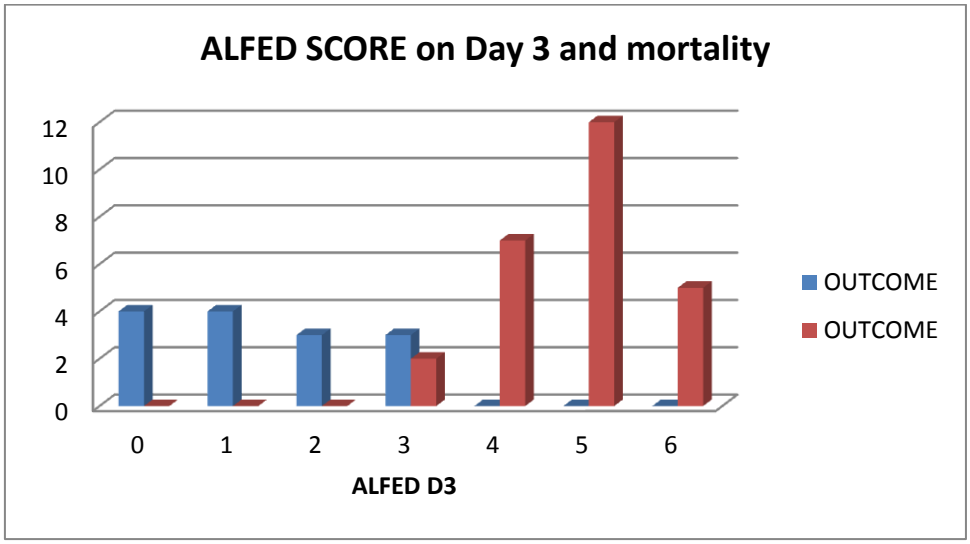

Figure 9

Table 11

ALFED Risk Group	OUTCOME		TOTAL n(%)
	Survived n(%)	Died (%)	
Low (0-1)	8(57.1)	0(0.0)	8(20)
Moderate (2-3)	6(42.9)	2(7.7)	8(20)
High (4-6)	0(0.0)	24(92.3)	24(60)

Parsons chi square=33.407, P value≤0.0001*.
*significant at 5%

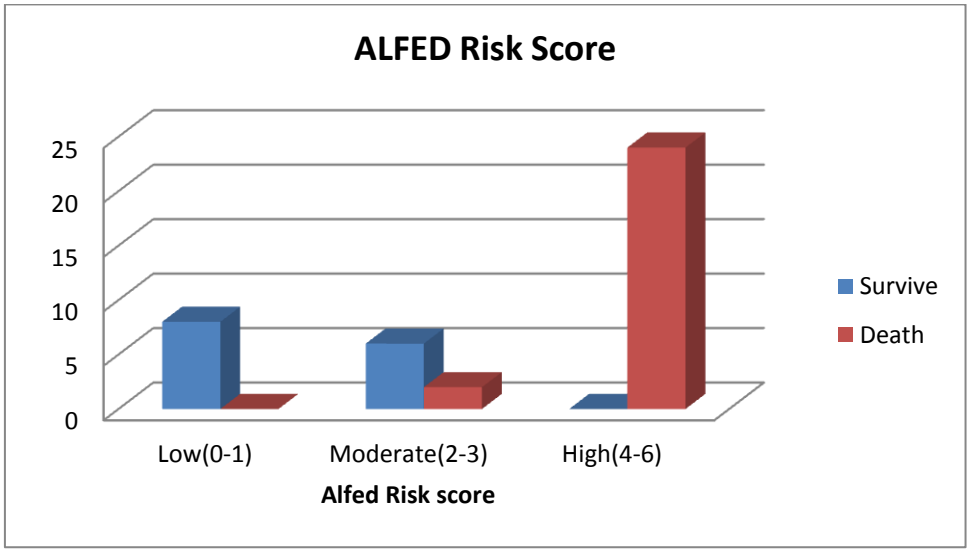

Figure 10

Comparison of KCH, MELD at admission and ALFED at day 3 at their cut off levels for LT (table 12, figure 11) showed that Out of 21 patients with KCH ≥3, 24% (n=5) survived without LT. Out of 12 patients with MELD score at admission ≥35, 25% (n=3) survived without LT, While as 24 patients were classified as high risk by ALFED model, none of the patients survived.

Comparison of KCH, MELD, ALFED Scores on day 3 at their cut off levels, (table 13,fig,12) showed that 32 patients were having KCH≥3 out of them 28% (n=9) survived. 18 patients had a MELD Score ≥35,out of which only 5.5%(n=1) survived, while as ALFED classified 24 patients as high risk ,none of them survived.

Table 12

DIFFERENT MODELS	Survive n=14(%)	Death n=26(%)	Total	p-value
KCH at admission ≥3	5(24%)	16(76%)	21	0.18
MELD at admission ≥35	3(25%)	9(75%)	12	0.48
ALFED ≥4 ,at DAY 3	0(0.0%)	24(100%)	24	≤0.0001

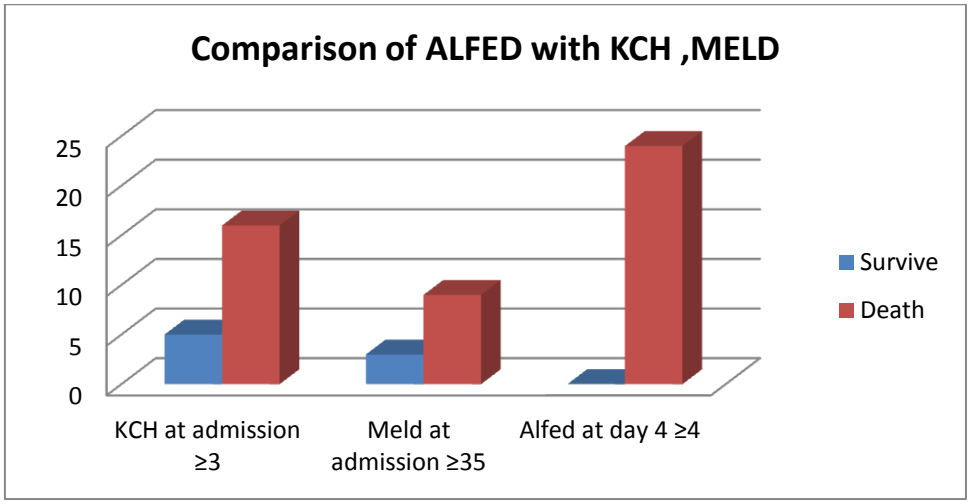

Figure 11

Table 13

Models on day 3	Survived 14(%)	Died 26(%)	Total (%)	P value
KCH≥3	9(28.0)	23(72)	32	0.102
MELD≥35	1(5.6)	17(94.4)	18	0.001
ALFED≥4	0(0.0)	24(100)	24	≤0.0001

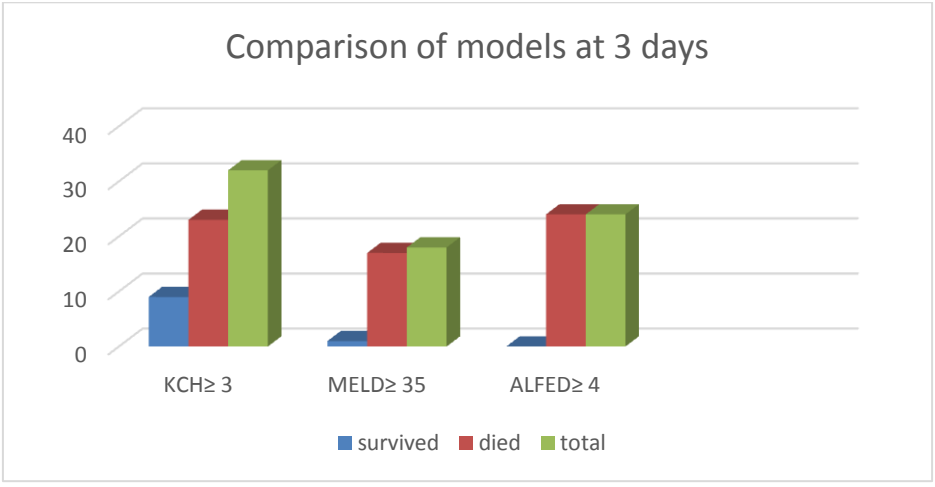

Figure 12

While comparing Sensitivity, specificity, positive predictive value, negative predictive value for ALFED, MELD and KCH criteria (at different cut-off levels), we found that ALFED on day 3 with cut off score ≥4 has highest sensitivity, specificity, positive predictive value, negative predictive value and mortality and that is why ALFED ≥4 was taken as a cut off level as high risk group.

Table 14

MODELS	Mortality%	Sn%	Sp%	PPV	NPV
ALFED≥3	89	100	78	89	100
ALFED≥4	100	92	100	100	87
ALFED≥5	100	65	100	100	60
MELD≥35 at admission	90	34	92.8	90	43
MELD D3	94	65	92	94	59
KCH≥3 At admission	72	61	64	76	47
KCH at D3	68	88	35	71	62

The mean value of MELD on day 1 of survived and died patients was 28.08 and 31.36 respectively with P value of 0.146.While on day 3 it was 28.42 and 34.50 which was significant with P value of 0.008.Mean value of KCH on day 1 for survived and died was 2.14, 2.69 respectively with P value of 0.003 while as it was 2.57 and 3.23 on day 3 respectively with P value of 0.026.

Mean ALFED score for survived and died was 1.57 and 1.96 with P value of 0.272 while on day 3 mean score of 1.36 and 4.77 respectively with P value <0.0001 which is highly significant, as shown in table 15.

Table 15

Models	Outcome	Mean±SD	P value
KCH D1	Survived	2.14±0.770	0.003
	Died	2.69±0.736	
KCH D3	survived	2.57±1.08	0.026
	Died	3.23±0.710	
MELD D1	Survived	28.08±4.37	0.146
	Died	31.36±6.84	
MELD D3	Survived	28.42±5.43	0.008
	Died	34.50±6.33	
ALFED D1	Survived	1.57±1.22	0.272
	Died	1.96±0.958	
ALFED D3	Survived	1.36±1.151	<0.0001
	Died	4.77±0.86	

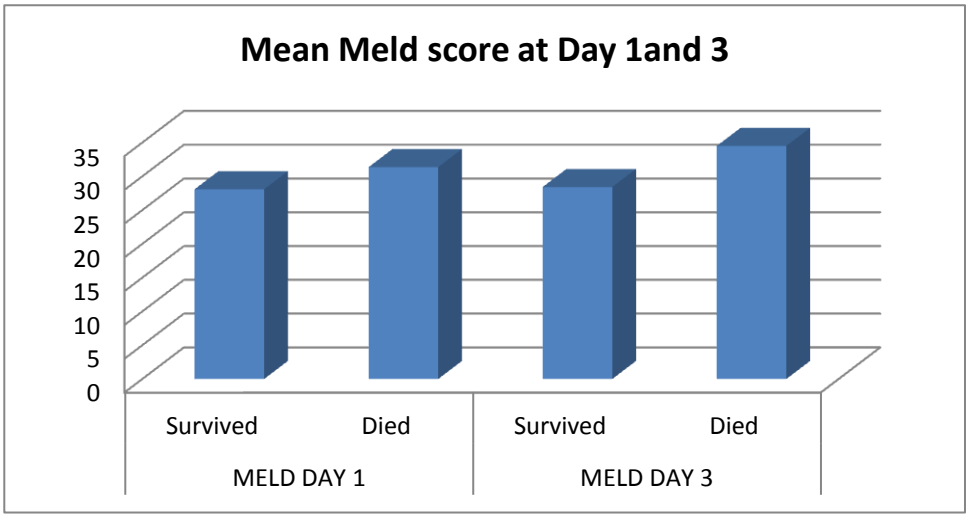

Figure 13

The mean ammonia on day 1 for survived and died was 102.21 and 118.65 with p value of 0.208 while as on day 3 mean ammonia of survived and died was 72.36 and 149.73 with a P value of < 0.0001 which was highly significant.

Mean bilirubin on day 1 of survived and died was 13.4 2 and 17.27 with P value of 0.126 while as on day 3 it was 15.57 and 20.7 with significant P value of 0.049.

INR on day 1 for survived and died patients was 2.68 and 3.48 with P value of 0.087 while INR for survived and died patients was 2.65 and 3.98 with significant P value of 0.0001.

Hence it shows that variables when taken on 3 consecutive days, P values become significant.

Table 16

Indicators on day 1 and day 3	Outcome	Mean±SD	P value
Day 1 Ammonia	Survived	102.21±25.89	0.208
	Died	118.65±43.9	
Day 3 Ammonia	Survived	72.36±27.81	<0.0001
	Died	149.73±38.75	
Day 1 Bilirubin	Survived	13.42±6.75	0.126
	Died	17.27±6.74	
Day 3 Bilirubin	Survived	15.57±7.61	0.049
	Died	20.7±7.60	
Day 1 INR	Survived	2.68±0.90	0.087
	Died	3.48±1.47	
Day 3 INR	Survived	2.65±0.903	0.0001
	Died	3.98±1.25	

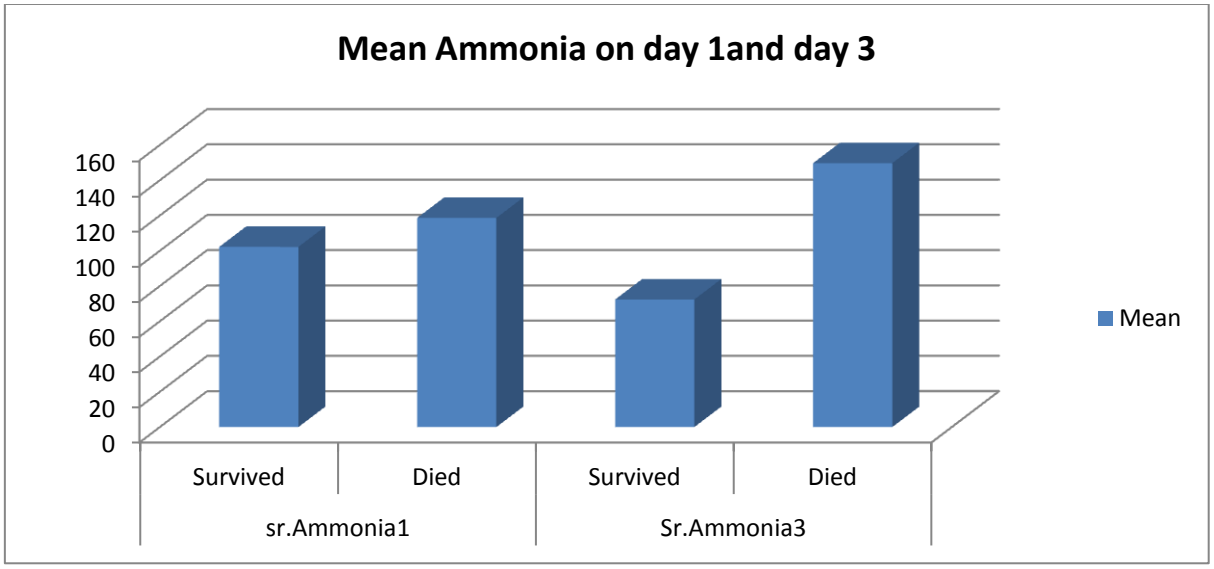

Figure 1

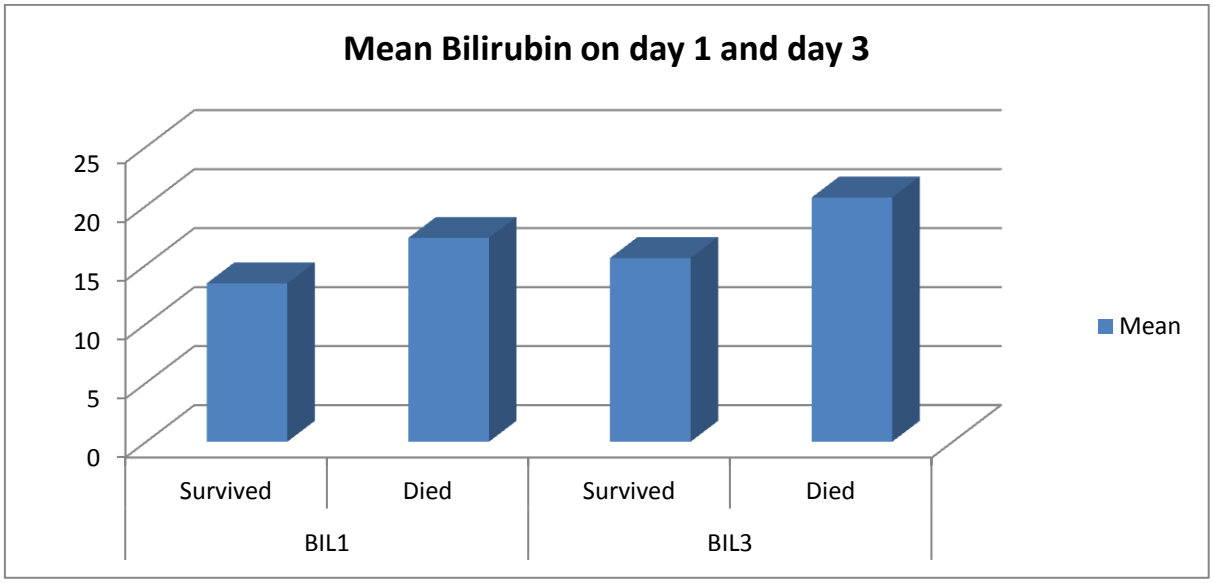

Figure 15

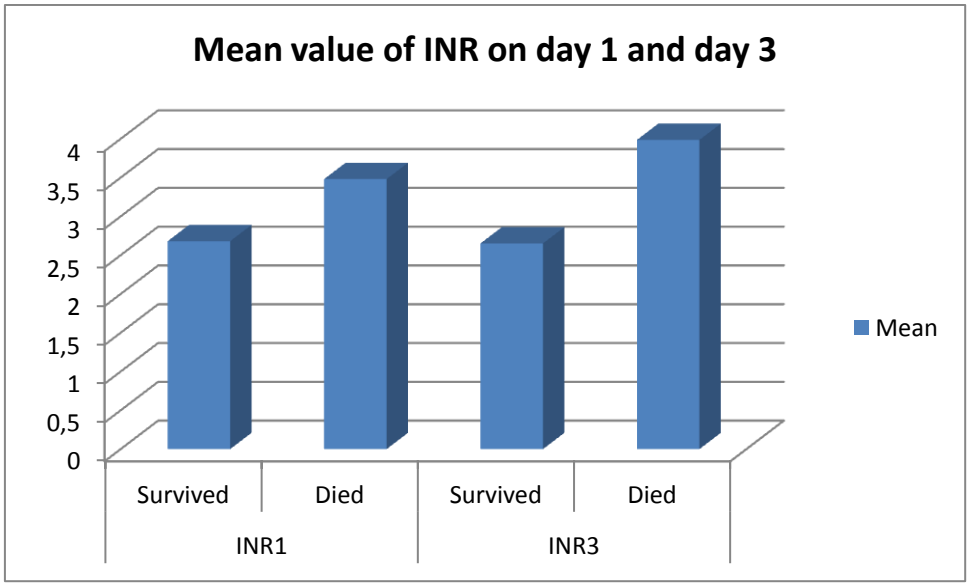

Figure 16

Discussion

Acute liver failure (ALF) is a rare but severe, life threatening, multisystemic medical emergency .Its rapid progression and high mortality demands early diagnosis and expert management .However a proportion of patients survive with supportive care only. The prognostic models used to predict mortality in ALF should be robust in order to select appropriate candidates for liver transplantation (LT) and to prevent avoidable LT. Further, the results of urgent LT in ALF continue to be inferior to non urgent LT. The preexisting models like MELD, KCH, Clichy, APACHEII, Group specific component are based on admission parameters and have poor accuracy in predicting outcome of ALF. Since ALF is a dynamic process where variables predicting the outcome on admission change over time. So a new prognostic model, the Acute Liver Failure Early Dynamic (ALFED) Model was devised [40]

Therefore we conducted a prospective study where in we applied this ALFED Model in our cohort of patients so as to validate it.

In our study the mean age of the patients was (28.3 years) , the most common etiological factor was undetermined (30%), the mean MELD score was (32.5), mean INR was (3.31), the mean bilirubin was (17.5 mg/dl), the percentage of

patients in grade I-II was (62.5%) and (37.5%) in grade III –IV encephlopathy. The Mortality in our study was (65%).

In a study conducted by Rameshkumar, Shalimar et al[40] the mean age of the patients was (26 years) ,the most common etiological factor for acute liver failure was undetermined (47%) , the mean MELD score was (35.96), the mean INR was (5.5),the mean bilirubin was 13mg/dl , the percentage of patients in grade I-II was (27%) and in grade III-IV was (73%).The mortality of ALF in their study was (55%).The performance of the ALFED model was superior to the King's College Hospital criteria and the Model for End stage Liver Disease score, even when their 3-day serial values were taken into consideration.An ALFED score of ≥4 had a high positive predictive value (85%) and negative predictive value (87%) in the validation cohort.[90]

In our study an ALFED score of ≥4 had a positive predictive value of (100%) and negative predictive value of (87%).The performance of ALFED model was superior to the KCH score and MELD score even when their 3 day values were taken into consideration.

In a study conducted by V Bhatia, R Singh et al 2006[41] Non-survivors in acute liver failure had significantly higher mean ammonia levels than survivors (174.7 v 105.0 mmol/l; p,0.001).

In a study conducted by Rameshkumar, Shalimar et,[40] advanced HE, INR, serum bilirubin and arterial ammonia independently predicted mortality.

In our study non survivours in acute liver failure had significantly higher mean ammonia levels than surviours (149.73mmol/l vs 72.36mmol/l; p0.0001)**.**

In a study conducted by Rameshkumar, Shalimar et[40] The performance of the ALFED model was superior to the King's College Hospital criteria and the Model for End stage Liver Disease score, even when their 3-day serial values were taken into considerationThe ALFED model accurately predicted outcome in patients with ALF, which may be useful inclinical decision-making

In our study we Compared ALFED, MELD and KCH at various cut off levels and found that 21 patients had KCH at admission ≥3, and out of them 24%(n5) survived and those with MELD at admission ≥35(n 12), out of them 25%(n 3) survived. However the patients (24) with ALFED ≥4 on day 3 of admission, 100% (n24) died.

In our study we found that the patients 37.5% (n15) were in grade III-IV encephalopathy and out of them 86% (n13) patients died.

While as 62.5% (n25) patients were in grade I-II encephlopathy and out of them 52%(n13) patients died.

In our study the results using ALFED score at day 3 were as follows,

At a score of(0 _ 1) out of 4 patients none died ,at a score of 2 no patient died ,at a score of 3 out of 5 patients 40% (n 2) died ,at a score of 4,5 and 6 the number of patients were 7, 12 and 5 respectively and mortality was100%).

In a study conducted by Rameshkumar, Shalimar et [90] they found that the risk of mortality by ALFED score at day 3 was as follows;

At a score of 0 out of 18 patients 5.6% (n1)died , at score of 1 out of 8 patients none died ,at score of 2 out of 14 patients 21% (n3) died, at a score of 3 out of 16 patients 19%(n3) died, at a score of 4 out of 24 patients 67% (n16) died, at a score of 5 out of 25 patients 84%(n21) died, at a score of 6 out of 31 patients 100% (n31) died.

Overall the mortality rates in the study conducted by Rameshkumar, Shalimar et al was 3.8 % in low risk group (ALFED 0-1), in moderate risk group (ALFED 2-3) was 19% and in high risk group (ALFED4-6) was 85%.

In our stud it was 0% in a low risk group, 25% in moderate risk and 100% in high risk group.

The results of our study are almost in agreement with the results of the studies published.

Conclusion

- Acute Liver Failure Early Dynamic Model (ALFED) is simple, reliable prognostic

model for Acute Liver Failure and more accurately predicts the outcome of ALF.

- Assists clinicians to select appropriate candidates for Liver Transplantation and to avoid un-necessary transplantation, which is expensive, has perioperative mortality and needs lifelong immunosuppression.
- ALFED model is superior to both KCH and MELD scores even when their 3 day scores are taken into consideration in predicting outcome in ALF.

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