Family Satisfaction About Outcomes for Acute Liver Failure Patients with Fluid, Electrolyte, And Acid-Base Disturbances

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Abstract: Background: Family satisfaction is considered an important indicator of outcomes in care. Good patient management leads to family satisfaction and significant improvement in acute liver failure patients' outcomes. Objective: To assess Family satisfaction about outcomes for acute liver failure patients with fluid, electrolyte, and acid base disturbances. Design: A descriptive research design was utilized to fulfill the aim of this study. Participants:-eighty family members for patients with acute liver failure. Method: Two tools were used to gather the data, the tool I acute liver failure patient assessment sheet, in which includes demographic data, hemodynamic and laboratory data. Tool II the patients' outcomes evaluation sheet and family satisfaction questionnaires used to assess Family satisfaction about outcomes for acute liver failure patients with fluid, electrolyte, and acid base disturbances. Results: The majority of families were satisfied with the management and outcomes of acute liver failure patients with fluid, electrolyte, and acid base disturbances. Conclusion: Families are satisfied with care, outcomes, and the information they received about their patients.

Keywords: Family, Satisfaction, Acute Liver Failure.

1. Introduction

Operation of physiological systems depends upon fluid and electrolyte balance; however, over the lifespan, diseases of fluid and electrolyte balance negate this, and the underlying causes can be diverse. The management of hydration and electrolyte balance involves nurses significantly. [1] Promoting patient safety and avoiding problems for good patient outcomes depend on nurses' understanding of age-specific concerns during the administration of IV fluids. [2]

Acute liver failure (ALF) is an uncommon illness that is defined by coagulopathy (International Normalized Ratio (INR) > 1.5) and an altered level of awareness due to hepatic encephalopathy. ALF occurs without underlying chronic liver disease. ALF frequently results in severe multi organ failure that progresses quickly and has unpredictable side effects. [3]

Being seriously ill causes not just the sufferer's but also their immediate relatives' significant distress. The wants and wishes of the intensive care patient are mediated by family members, who also serve as a health-promoting resource that can enhance patient outcomes. [4].

Family satisfaction is an ill-defined idea. In truth, neither "family" nor "satisfaction" have a clear definition or are applied consistently. A group of people with a deep familial, social, or emotional connection to the patient is referred to as "family" in this context. In addition to the patient's immediate family, this could also include other people with a close connection to them. Different societal, cultural, or religious perspectives on what such a family may look like may be pertinent [5].

Many families find that the time spent in the intensive care unit (ICU) is difficult and rife with ambiguity regarding the patient's condition, course of treatment, and outlook. The experience and appearance of the intensive care patient,

as well as the surroundings of the hospital bed, are described by family members as scary and surreal. They desire to be involved in the treatment of patients and the decision-making process [5-7].

In terms of both their position as supporters for the patients and their own needs, family members' wants and wishes are crucial. According to studies, there may be a high prevalence of depression, PTSD, or PICS-Family among family members during an ICU stay [6, 7].

Family satisfaction with the treatment the patient receives during an ICU stay can be a crucial piece of information utilized to improve the overall quality of the ICU, making sure that the care delivered satisfies the needs of both the patient and the family [4].

2. SUBJECTS AND METHODS

2.1. Research Design

A descriptive research design was utilized to fulfill the aim of this study.

2.2. Setting

The study was carried out at Assiut University Hospital, Egypt, in the Tropical Intensive Care Unit at Alrajhy Liver Hospital between May 2022, and May 2023.

2.3. Study subjects:

Eighty family members for patients with acute liver failure.

2.3.1. Inclusion and exclusion criteria for Patients

Family members of Patients diagnosed with acute liver failure by the physician, with a length of stay in the ICU >3 days and an age >18 years, were included. And Family members of Patients not diagnosed with acute liver failure by the physician were excluded.

2.3.2. Sample size

Based on the previously reported frequency of acute liver cell failure of 8%, with a p-value < 0.05 and 90% power, confidence level of 0.95, a minimum of Eighty (80) patients will be required for the study analysis. **[8]**

2.4. Tools

Two tools were used to collect data related to the study.

2.4.1. Tool I: acute liver failure patient assessment sheet included demographic, hemodynamic, and laboratory data.

2.4.2. Tool II: Patients' outcomes evaluation sheet and family satisfaction questionnaires used to assess Family satisfaction about outcomes for acute liver failure patients with fluid, electrolyte, and acid-base disturbances.

2.5. Method

- The research proposal was approved by the Ethics Committee of the Faculty of Nursing, Assiut University, Egypt (IRB no. 3820027).

- Official permission to conduct the study was obtained from the hospital's responsible authorities after an explanation of the aim of the study.

- Oral permission to conduct the study was obtained from the Family members of eligible patients after an explanation of the aim of the study.
- Ethical consideration:-
  - Research proposal was approved from Ethical Committee in the faculty of nursing.
  - There was no risk for study subject during application of the study.
  - The study followed common ethical principles in clinical research.
  - Written consent was obtained from patients or guidance that participated in the study, after explaining the nature and purpose of the study.
  - Patient was assured that the data of this research was not be reused without second permission.
  - Confidentiality and anonymity was assured.
  - Patients had the right to refuse to participate or withdraw from the study without any rational at any time.

- The following data were collected:

- Full history-taking and clinical evaluation included age, sex, body mass index, residence, and underlying comorbidities such as diabetes mellitus, hypertension, and chronic kidney disease.

- Baseline and follow up laboratory data included a complete blood count, liver function tests, an international randomized ratio, urea, creatinine, serum electrolytes (sodium, calcium, potassium, and phosphorus), serum lactate, arterial blood gases, and oxygen saturation.

- Outcome of the studied patients, length of hospital stay, and frequency of complications

- Family members of eligible patients were approached to participate. The questionnaire measures family satisfaction with the care given to the patient and their family during the ICU stay.

- Family satisfaction with regard to the management of acute liver cell failure is either satisfied or dissatisfied. The degree of satisfaction was assessed based on a Likert scale of satisfaction. The 5-point Likert scale contains five response options that will consist of two extreme sides and a neutral option linked to the middle answer options. Examples of a 5-point rating scale for measuring satisfaction are: Very Satisfied, Satisfied, Neutral, Dissatisfied, and Very Dissatisfied. In the current study, family members were either satisfied or dissatisfied.

2.6. Statistical analysis

The collected data were coded, processed, and analyzed using SPSS (Statistical Package for Social Sciences) version 22 for Windows® (IBM SPSS Inc., Chicago, IL, USA). The data were tested for normal distribution using the Shapiro Walk test. Qualitative data was represented as frequencies and relative percentages. Quantitative data were expressed as mean ± SD (Standard deviation). A paired t-test was used to compare baseline and follow up laboratory data. Logistic regression analysis was used to determine predictors of mortality among those patients by determining the odds ratio (OR). A P value < 0.05 was considered significant.

3. RESULTS

Table 1: Baseline demographic data of the studied patients

	N= 80
Age (years)	34.45 ± 12.22
Sex	
Male	60 (75%)
Female	20 (25%)
Body mass index (kg/m^2)	23.05 ± 2.09
Residence	
Rural	55 (68.8%)
Urban	25 (31.2%)
Diabetes mellitus	10 (12.5%)
Hypertension	4 (5%)
Chronic kidney disease	2 (2.5%)

Data expressed as frequency (percentage), mean (SD)

Baseline demographic data of the studied patients (table 1): The mean age of the studied patients was 34.45 ± 12.22 years. The majority (75%) of patients were male. Diabetes mellitus, hypertension, and chronic kidney disease were present in 10 (12.5%), 4 (5%), and 2 (2.5%) patients, respectively. The majority (68.8%) of patients came from rural areas.

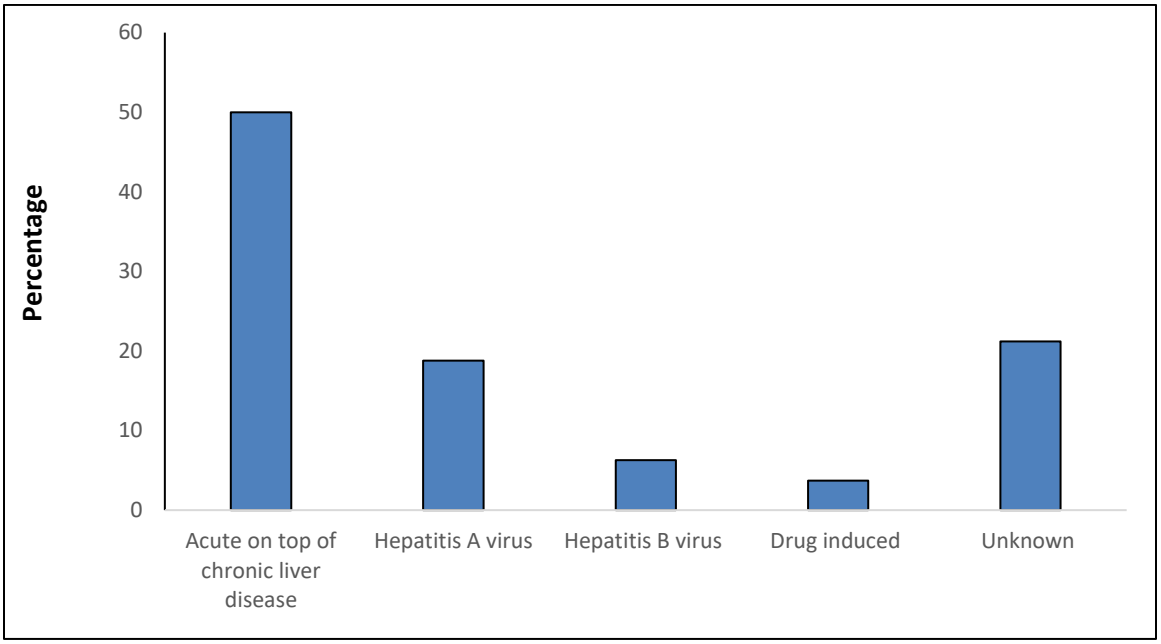

Figure 1: A etiology of liver cell failure among the studied patients

Etiology of acute liver cell failure among the studied patients (figure 1): Fifty percent of patients had liver cell failure (LCF) secondary to acute liver disease on top of chronic liver disease. Hepatitis A virus and hepatitis B virus infections were positive in 15 (18.8%) and 5 (6.3%) patients, respectively. Three patients had drug-induced liver cell failure. The etiology of acute LCF was unknown in 17 (21.2%) patients.

Table 2: Baseline and follow-up laboratory data among the studied patients

	Baseline	Follow up	*P* value
Hemoglobin (mg/dl)	10.34 ± 2.55	11.09 ± 1.87	0.45
Leucocytes (10^3/ul)	4.77 ± 1.01	5.11 ± 0.69	0.09
Platelets (10^3/ul)	155.66 ± 22.245	157.09 ± 33.34	0.22
Bilirubin (umol/l)	107.88 ± 43.65	32.22 ± 8.76	**< 0.001***
Direct bilirubin (umol/l)	80.55 ± 20.19	18.11 ± 3.56	**< 0.001***
AST (u/l)	789.88 ± 145.11	123.33 ± 33.11	**< 0.001***
ALT (U/L)	801.35 ± 201.34	130.11 ± 21.65	**< 0.001***
Albumin (mg/dl)	32.02 ± 8.88	33.11 ± 7.80	0.67
ALP (u/l)	101.11 ± 25.55	103.22 ± 30.76	0.12
Creatinine (mg/dl)	1.01 ± 0.37	1.04 ± 0.40	0.08
Urea (mg/dl)	23.33 ± 4.11	25.87 ± 5.55	0.32
INR	1.90 ± 0.22	1.20 ± 0.11	**0.01***
Sodium (mmol/l)	133.33 ± 28.90	131.11 ± 27.71	0.44
Potassium (mg/dl)	3.59 ± 0.90	4.10 ± 1.11	0.10
Calcium (mg/dl)	9.01 ± 2.22	8.66 ± 3.10	0.05
Phosphorus (mg/dl)	3.33 ± 0.44	3.40 ± 0.24	0.19
Lactate (mmol/l)	4.44 ± 0.50	1.50 ± 0.25	**< 0.001***
pH^+	7.39 ± 0.03	7.38 ± 0.04	0.17
Oxygen saturation (%)	98.98 ± 0.44	99.01 ± 0.22	0.06

Data is expressed as mean (SD). *P* value was significant if < 0.05. AST: aspartate transaminase; ALT: alanine transaminase; ALP: alkaline phosphatase; INR: international randomized ratio.

Baseline and follow-up laboratory data among the studied patients (table 2): During follow-up of those patients, there was a significant reduction in bilirubin, direct bilirubin, aspartate transaminase, alanine transaminase, lactate, and the international randomized ratio (p< 0.05). Other laboratory data were comparable between baseline and follow-up assessments.

Table 3: Outcome of the studied patients in the current study

	N= 80
Hospital stay (day)	16.22 ± 3.33
Complications	20 (25%)
Outcome	
Alive	35 (43.8%)
Died	45 (56.2%)

Data is expressed as frequency (percentage).

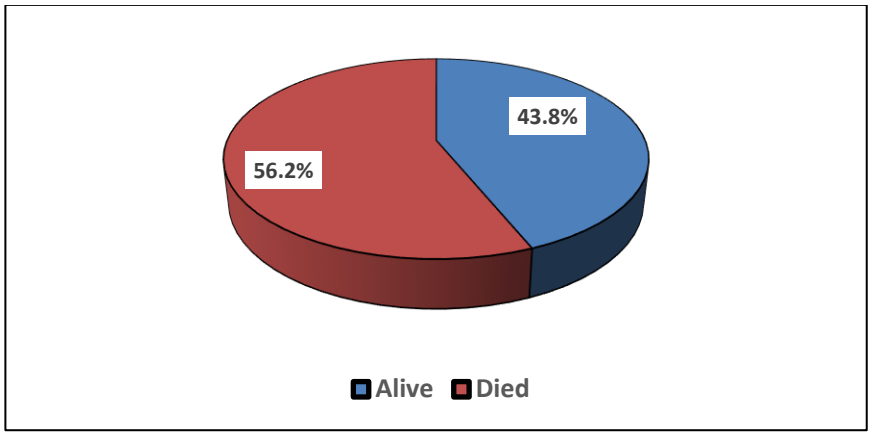

Figure 2: Outcome of the studied patients with acute liver cell failure

Outcome of the studied patients in the current study (table 3, figure 2): Out of the studied patients; 35 (43.8%) patients improved and were alive meanwhile, 45 (56.2%) patients were deteriorated and died.

Table 4: Family satisfaction as regards the management of acute liver cell failure in the current study

	N= 80
Satisfaction	
Satisfied	60 (75%)
Dissatisfied	20 (25%)

Data is expressed as frequency (percentage).

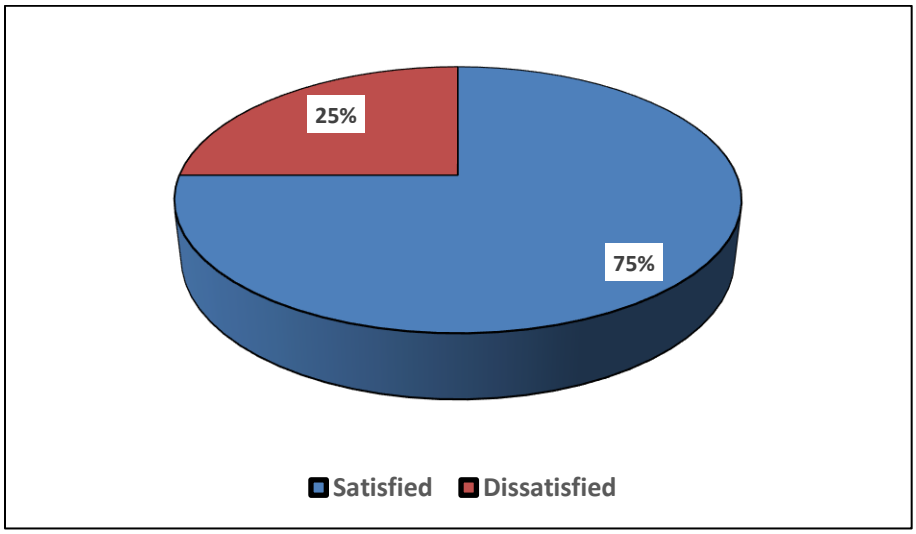

Figure 3: Family satisfaction as regards the management of acute liver cell failure in the study

Family satisfaction as regards the management of acute liver cell failure in the current study (table 4, figure 3): Out of the studied patients, 60 (75%) patients' families were satisfied with their management, while the other 20 (25%) families were dissatisfied.

Table 5: Predictors of mortality among the studied patients

	Odd's ratio	95% confidence interval	*P* value
Old age (years)	1.01	0.45-2.22	0.33
Underling chronic disease	3.22	2.12-7.91	**< 0.001***
Unknown etiology	2.09	1.56-4.11	**0.01***
Bilirubin (umol/l)	0.98	0.22-1.90	0.11
Albumin (mg/dl)	1.23	1.11-3.01	0.33
INR	1.45	1.23-2.09	**0.04***
Lactate (mmol/l)	1.90	1.33-2.99	**0.02***
pH^+	1.66	1.19-3.01	**0.03***
Complications	3.11	2.90-8.11	**< 0.001***

Data is expressed as a mean (SD). The P value was significant if < 0.05. AST: aspartate transaminase; ALT: alanine transaminase; ALP: alkaline phosphatase; INR: international randomized ratio.

Predictors of mortality among the studied patients (table 5): Based on the current study; predictors of mortality among patients with acute liver failure were underlying chronic disease (OR = 3.22), unknown etiology (OR = 2.09), INR (OR = 1.45), lactate (OR = 1.90), pH+ (OR = 1.66), and complications (OR = 3.11).

4. DISCUSSION

family satisfaction serve as a key element for care improvement. this may help to analyze strengths and weaknesses in the process of care of the critically ill and regularly performed assessment of family satisfaction can be used to follow specific key variables over time to monitor the success of improvement**[5].**

In the researcher opinion the family satisfaction an important part in patients' care and outcomes. staff nurses provide high standard of care to patient that leads to family satisfaction and significant improvement in acute liver failure (ALF) patients' outcomes.

Acute liver failure (ALF) is a rapidly progressive, potentially fatal syndrome caused by a large variety of insults. It is defined as the presence of biochemical evidence of liver injury (deranged transaminases) and coagulopathy not corrected by parenteral vitamin K administration with an International Normalized Ratio (INR) ≥1.5 in the presence of encephalopathy or an INR >2 with no evidence of encephalopathy **[9]**.

In the current study, a total of (80) acute LCF patients with fluid, electrolyte, and acid base disturbances were enrolled. The study aimed to assess the outcome among patients with acute LCF patients with fluid, electrolyte, and acid base disturbances and their families satisfaction as regards the management of acute liver cell failure in the current study. The mean age of the studied patients was 34.45 ± 12.22 (years). The majority (75%) of patients were males. In line with the current study, many previous studies have stated males predominance among patients with acute liver cell failure **[9-10].**

The main findings in the current study were; 1) the most frequent etiologies were acute on top of chronic liver disease half of patients (50%) and near quarter of them unknown (21.2%), 2) near half of them 35 (43.8%) patients improved and were alive meanwhile, above half of them 45 (56.2%) patients were deteriorated and died, 3) Out of the studied patients; the majority 60 (75%) patients' families were satisfied as regard their management while the other 20 (25%) families were dissatisfied, and 5) predictors of mortality of among patients with acute liver failure were underlying chronic disease (OR= 3.22), unknown etiology (OR= 2.09), INR (OR=1.45), lactate (OR= 1.90), pH^{+} (OR= 1.66) and complications (OR= 3.11).

The true incidence of ALF is unclear because there is scarce data from previous studies, which were mostly done in liver transplant units or tertiary referral centers. The estimated annual incidence of ALF is 5.5 cases per million people per year in the United States, according to a population-based study, and 6.2 cases per million people per year in Scotland in liver transplant centers **[11].**

The etiology of ALF is an important factor in prognosis and management. The main causes of ALF are different in each area of the world. The predominant cause of ALF is acetaminophen in the United States, the United Kingdom, and Australia (36–43%). In Asian countries, the predominant causes are acute hepatitis virus infections, specifically hepatitis E virus in India (43.9%) and hepatitis B virus in Japan (32.7%) and Taiwan (33%). Indeterminate causes are the leading etiologies of ALF in Scandinavian countries (43%), Chile (44%), and Sudan (38%) **[10]**.

In terms of outcome after hospital admission, many ALF patients have complications such as infections and multiple organ failures, a high mortality rate, and a high cost for management **[12]**. In the current study, the majority of patients died. A previous single-center study from the United Kingdom by R. Marudanayagam et al. reported that the 30-day mortality was 26.7% without liver transplant and 13.7% with liver transplant in ALF patients who were admitted between January 1992 and May 2008 **[13]**.

Also, another study found that the overall in-hospital and 30-day mortality rates of hospitalized ALF patients were 18.4 and 26.7%, respectively **[10]**. This discrepancy with our study may be attributed to the different studied population, sample size, as well as the fact that we enrolled patients with acute on top chronic liver cell failure.

Comparable with the current findings; previous study noticed that etiology was established in 91% of cases. Viral infections were the most common cause. The mortality rate was 44% **[8]**.

Identifying patients who have poor survival outcomes is essential and will lead to prompt referral and consideration for emergency liver transplantation. Previous studies show that encephalopathy, extra hepatic organ failure (especially renal failure), and coagulopathy are poor prognostic factors for mortality. In addition, short-term outcomes vary according to etiology. A favorable prognosis was found with acetaminophen- and ischemic-induced ALF (60–80% short-term survival without transplantation) and a poor prognosis with hepatitis B infection, indeterminate cause, and drug other than acetaminophen-related ALF (17–25% short-term survival without transplantation) **[14-15].**

Previous studies found that the most influential predictive factors for 30-day mortality were acute renal failure (OR = 3.64, 95% CI: 3.43–3.87, $p < 0.001$), malignant infiltration of the liver (OR = 3.37, 95% CI: 2.94–3.85, $p < 0.001$), and septicemia (OR = 1.96, 95%CI: 1.84–2.08, $p < 0.001$) **[10]**.

Previous study showed 66 % of patients had spontaneous recovery with supportive care therapy. Additionally, age ≥ 60 years, co-morbidities, malignant infiltration, Hepatitis B or C virus infection, indeterminate etiology, and infectious complications including ARF, septicemia, and pneumonia are independent predictors for 30-day mortality as well **[16].**

Our study was considered the first study discuss family satisfaction with the management of acute liver cell failure. We found that the majority of families were satisfied with management.

A previous study stated that although families were very satisfied with the ICU stay, several areas were identified as having potential for improvement. The results showed that some of the family demographic variables were significant for family satisfaction. The findings are clinically relevant since the results can strengthen intensive care nurses' knowledge when meeting the family of the intensive care patient [**17].** But they didn't assess family satisfaction in cases of acute liver cell failure.

Low satisfaction with either pain or agitation relief has been reported in several earlier studies where FS-ICU 24 was utilized. During an ICU stay, many patients develop delirium, which can cause agitation and confusion. It can be frightening and difficult for the family to see that their loved ones are in pain and that there is a change in their mental status **[18-20]**.

Meanwhile, our study had certain limitations, included relatively small sample size, short term follow up of patients, and the fact that we enrolled different etiologies in our study.

CONCLUSION

Based on the results of this study, it could be concluded that acute liver cell failure is fairly common and could have a bad prognosis. Early identification and proper management are the mainstays for patients with acute liver cell failure. Underlying chronic liver disease, the occurrence of complications, and unknown etiologies are the main predictors of mortality. Future studies are warranted to draw firm conclusions and assess the family's satisfaction.

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Conflict of interest

We declare that we have no conflicts of interest.

REFERENCES

[1] Kear TM, (2017). Fluid and Electrolyte Management Across the Age Continuum, NephrolNurs J. Nov-Dec 2017; 44(6):491-496.

[2] Gorski, L. (2017). Infusion Therapy Standards of Practice. Journal of Infusion Nursing, 39(1S), 11–18. www.journalofinfusionnursing.com.

[3] Trovato F, RabinowichL and McPhail MJ.(2019). Update on the management of Acute Liver Failure. See discussions, stats, and author profiles for this publication at: https://www.researchgate.net/publication/330735228.

[4] Haave RO, Bakke HH and Schröder A. (2021). Family satisfaction in the intensive care unit, a cross-sectional study from Norway Haave et al. BMC Emergency Medicine. https://doi.org/10.1186/s12873-021-00412-8.

[5] Hans UR, Kay HS and Daren KH (2010) Family satisfaction with critical care :measurements and messages : Current Opinion in Critical Care. December 2010 - Volume 16 - Issue 6Current Opinion in Critical Care 16(6):p 623-631, December 2010.| DOI: 10.1097/MCC.0b013e32833e9718.

[6] Davidson JE, Jones C, Bienvenu OJ. (2010). Family response to critical illness: post intensive care syndrome-family. Crit Care Med. 2012;40(2):618-24.

a. https://doi.org/10.1097/CCM.0b013e318236ebf9.

[7] van Beusekom I, Bakhshi-Raiez F, de Keizer NF, Dongelmans DA, van der Schaaf M, et al. (2016). Crit Care. 2016;20(1). https://doi.org/10.1186/s13054-016-1185-9.

[8] Stravitz RT, Lee WM. Acute liver failure. The Lancet.(2019) Sep 7;394(10201):869-81.

[9] Bhatia V, Singh R, Acharya SK. Predictive value of arterial ammonia for complications and outcome in acute liver failure. Gut. 2006 Jan 1;55(1):98-104.

[10] Thanapirom K, Treeprasertsuk S, Soonthornworasiri N, Poovorawan K, Chaiteerakij R, Komolmit P, Phaosawasdi K, Pinzani M. (2019) The incidence, etiologies, outcomes, and predictors of mortality of acute liver failure in Thailand: a population-base study. BMC gastroenterology. 2019 Dec;19:1-7.

[11] Bower WA, Johns M, Margolis HS, Williams IT, Bell BP. (2007) Population-based surveillance for acute liver failure. Am J Gastroenterol. 2007;102(11):2459–63.

[12] Hagström, H., Nasr, P., Ekstedt, M., Stål, P., Hultcrantz, R. and Kechagias, S., (2019) Accuracy of noninvasive scoring systems in assessing risk of death and liver-related endpoints in patients with nonalcoholic fatty liver disease. Clinical gastroenterology and hepatology, 17(6), pp.1148-1156.

[13] Marudanayagam R, Shanmugam V, Gunson B, Mirza DF, Mayer D, Buckels J, Bramhall SR. (2009) Aetiology and outcome of acute liver failure. HPB. 2009;11(5):429–34.

[14] European Association for the Study of the Liver, Electronic address eee, clinical practice guidelines p, Wendon J, Members P, Cordoba J, Dhawan A, Larsen FS, Manns M, Samuel D, Simpson KJ, et al. (2017) EASL clinical practical guidelines on the management of acute (fulminant) liver failure. J Hepatol;66(5):1047–81

[15] Ostapowicz G, Fontana RJ, Schiodt FV, Larson A, Davern TJ, Han SH, McCashland TM, Shakil AO, Hay JE, Hynan L, et al. (2002) Results of a prospective study of acute liver failure at 17 tertiary care centers in the United States. Ann Intern Med. 2002;137(12):947–54.

[16] Larson AM, Polson J, Fontana RJ, Davern TJ, Lalani E, Hynan LS, Reisch JS, Schiodt FV, Ostapowicz G, Shakil AO, et al. (2005) Acetaminophen-induced acute liver failure: results of a United States multicenter, prospective study. Hepatology;42(6):1364–72

[17] Haave RO, Bakke HH, Schröder A. .(2021) Family satisfaction in the intensive care unit, a cross-sectional study from Norway. BMC emergency medicine. 2021 Dec;21:1-2.

[18] Devlin JW, Skrobik Y, Gelinas C, Needham DM, Slooter AJC, Pandharipande PP, et al. (2018) Clinical practice guidelines for the prevention and Management of Pain, agitation/sedation, delirium, immobility, and sleep disruption in adult patients in the ICU. Crit Care Med. 2018;46(9):e825–e73.

[19] Schwarzkopf D, Behrend S, Skupin H, Westermann I, Riedemann NC, Pfeifer R, et al. . (2013) Family satisfaction in the intensive care unit: a quantitative and qualitative analysis. Intensive Care Med. 2013;39(6):1071–9.

[20] Osborn TR, Curtis JR, Nielsen EL, Back AL, Shannon SE, Engelberg RA. (2012) Identifying elements of ICU care that families report as important but unsatisfactory: decision-making, control, and ICU atmosphere. Chest. 2012;142(5):1185–92.

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