

# Etiology, Outcome and Prognostic Factors of Childhood Acute Liver Failure in Germany

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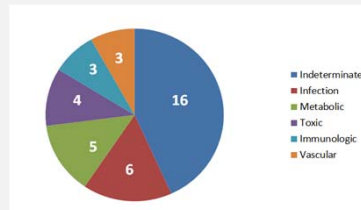
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## Background & Aims:

Pediatric acute liver failure (PALF) is a rapidly progressive, potentially fatal clinical syndrome occurring in previously healthy children. Aim of our study was to detect the current leading causes of PALF in a single center in Germany, and to identify possible prognostic clinical and biochemical markers.

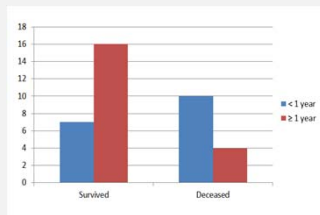
## Methods:

From January 2010 until December 2013, 37 pediatric patients with PALF were included in our study. Medical records were reviewed for demographic, laboratory and clinical data. Laboratory results on admission as well as peak values (ALT, AST, creatinine, bilirubin, INR, albumin, ammonia), PELD and MELD score on admission as well as clinical parameters (ventilation, hemodialysis, circulatory support) were assessed and analyzed.



**Figure 2 and Table 1:**  
Distribution of etiologies in PALF patients.

Type of liver injury	Patients (total 37)	Individual breakdown of etiologies
Infectious	6 (16%)	Neonatal HSV infection (3) HAV/EBV coinfection HBV/HDV coinfection Adenovirus infection
Metabolic	5 (13.5%)	Mitochondrial diseases (3) Wilson's disease Gauchers disease
Toxic	4 (11%)	Amanita Bacillus cereus Lamotrigen Amoxicilline
Immunologic	3 (8%)	Lupus erythematosus Autoimmune hepatitis Gestational alloimmune liver disease
Vascular	3 (8%)	Acute portal vein thrombosis Budd-Chiari syndrome Venous occlusive disease
Indeterminate	16 (43%)	



**Figure 1:**  
Prognosis related to age

## Results:

### Demographics and etiology:

Fifteen (41%) patients recovered spontaneously, 14 (38%) patients died without transplantation, and 8 (21%) patients received a liver transplant. Patients who survived were significantly older than patients who died ( $p=0.039$ ; figure 1). Specific causes of PALF could be identified as infectious diseases (16%), metabolic diseases (14%), toxic liver injury (11%), immunologic diseases (8%), or vascular diseases (8%). Causes of PALF remained indeterminate in 16 patients (43%) (figure 2, table 1).

## Predictors of outcome:

### Biochemical values:

High ammonia levels ( $p=0.047$ ), low albumin levels ( $p=0.011$ ) and low ALT levels ( $p=0.007$ ) on admission were associated with worse outcome. Further predictor of worse outcome were high peak ammonia levels ( $p=0.030$ ) (table 2 and 3).

### Clinical signs:

Predictor of spontaneous recovery were absence of ventilation, hemodialysis, and circulatory support ( $p=0.003$ ,  $p=0.005$ ,  $p=0.0002$ ).

**Conclusions:** Infectious diseases are the most common known cause of PALF. However, in a large proportion of patients the cause for PALF remains cryptic. Ammonia and albumin levels and clinical parameters may be of prognostic value to predict outcome.

Parameter	SR <sup>1</sup>	NSR <sup>2</sup>	P value
AST	5447 U/l ( $\pm 4743$ )	2801 U/l ( $\pm 3360$ )	0.055
ALT *	3542 U/l ( $\pm 3350$ )	1279 U/l ( $\pm 1340$ )	0.007
INR	2.063 ( $\pm 1.004$ )	2.687 ( $\pm 1.242$ )	0.115
Bilirubin	7.547 mg/dl ( $\pm 6.114$ )	10.70 mg/dl ( $\pm 10.18$ )	0.290
Creatinine	0.811 mg/dl ( $\pm 0.693$ )	0.878 mg/dl ( $\pm 0.896$ )	0.810
Ammonia*	96.93 $\mu$ g/dl ( $\pm 52.13$ )	147.4 $\mu$ g/dl ( $\pm 83.52$ )	0.047
Albumin*	3.25 g/dl ( $\pm 0.58$ )	2.76 g/dl ( $\pm 0.46$ )	0.011
MELD <sup>3</sup>	21.1 ( $\pm 7.0$ )	24.5 ( $\pm 7.5$ )	0.068
PELD <sup>4</sup>	12.8 ( $\pm 7.1$ )	20.1 ( $\pm 11.8$ )	0.074

**Table 2:** Biochemical parameters of PALF patients grouped by outcome.

<sup>1</sup>Spontaneous recovery group; <sup>2</sup>received transplant or deceased; <sup>3</sup> Model for end-stage Liver disease; <sup>4</sup> pediatric end-stage liver disease; \* significantly different between SR and NSR.

Parameter	SR <sup>1</sup>	NSR <sup>2</sup>	P value
AST	5592 U/l ( $\pm 4733$ )	5490 U/l ( $\pm 8259$ )	0.966
ALT	3635 U/l ( $\pm 3329$ )	2544 U/l ( $\pm 4169$ )	0.403
INR	3.004 ( $\pm 1.431$ )	3.935 mg/dl ( $\pm 1.382$ )	0.066
Bilirubin	11.67 mg/dl ( $\pm 8.628$ )	18.45 mg/dl ( $\pm 11.95$ )	0.068
Creatinine	1.234 mg/dl ( $\pm 1.594$ )	1.265 mg/dl ( $\pm 1.007$ )	0.943
Ammonia	141.87 $\mu$ g/dl ( $\pm 77.85$ )	366.71 $\mu$ g/dl ( $\pm 377.93$ )	0.030

**Table 3:** Biochemical parameters of PALF patients (peak values), grouped by outcome

Parameter	SR <sup>1</sup>	NSR <sup>2</sup>	P value
Ventilation on adm. <sup>3</sup>	3/15 (20%)	10/22 (45%)	0.165
Ventilation total	3/15 (20%)	16/22 (73%)	0.003
Hemodialysis on adm.	0/15	3/22 (14%)	0.257
Hemodialysis total	1/15 (7%)	9/22 (41%)	0.005
Circulatory support on adm.	0/15	5/22 (23%)	0.067
Circulatory support total	0/15	15/22 (68%)	0.0002

**Table 4:** Clinical parameters of PALF patients grouped by outcome