

SIGNIFICANCE OF BLOOD TEST IN PATIENTS WITH
CORROSIVE INJURY OF AERODIGESTIVE TRACT

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Introduction: Corrosive injury of aero-digestive tract is a serious medical condition. In our study injuries were induced by concentrated acetic acid. The importance was focused on esophageal injury. We compared relationship of blood test values and degree of esophageal injury with reflection on the general condition of patient.

Aim: Aim of study was to find indicative blood tests for estimation of severity of esophageal injury in order to start optimal therapeutic approach to prevent serious and life threatening complications. Patients and methods: This study included 110 of 136 patients with established diagnosis of corrosive injury of aero-digestive tract. We took patient's medical history together with pharyngoscopy, indirect laryngoscopy, rigid esophagoscopy and blood tests. Results: Children up to 10 years of age participate with 17,3%, and females in general participate with 79% of all patients. Number of White blood cell, total and direct bilirubin, alanine aminotransferase and aspartate aminotransferase are highly elevated in severe injuries of esophagus ($p < 0.05$).

Conclusions: Blood tests are very useful in prediction of extent of corrosive injury in early phase of diagnostic assessment. We found number of white blood cells, bilirubin, alanine aminotransferase and aspartate aminotransferase that are indicative for prediction of severe esophageal injury with impact on general medical condition of patient.

Key words: corrosive, injury, esophagus, blood test,

INTRODUCTION:

Through the history the injury of aero-digestive tract with various corrosive agents represent permanent health, economic and social issue. Nowadays, the most common misuse of corrosive agents are in suicidal purposes, although we still have the accidental poisoning especially in children. There are rare attempts of murder with corrosive agents. There is a prevalence of these injuries in South East Europe [1]. Data from the American authors showed exposure to cleaning agents and detergents at rate of 200,000 cases per year [2]. In Denmark, these are mostly various kinds of acids (55%) with the most severe damage caused by using hydrochloric acid [3]. There is a challenge to predict severe esophageal injuries with toxic influence on general health condition of such patient in order to prevent serious and life threatening complications. There are a few investigations with different conclusions [15,16,17]. The purpose of this study was to determine the prognostic value of blood tests in cases of severe esophageal injury with impact on general health condition after corrosive injury of aero digestive tract. Also we had an intention to emphasize the importance of these injuries today in order to attract the public awareness on this issue. We found the prevention as one of the

most important factors in order to reduce the incidence of these injuries.

PATIENTS AND METHODS:

This is retrospective study that covers period from 1991 till 1997. It includes 110 of 136 patients with established diagnosis of corrosive injury of aero-digestive tract caused by acetic acid, sulfuric acid, and hydrochloric acid. Their ages ranged from 1 to 80 (mean 35). All medical investigations were performed at the Clinic center in Banja Luka. We used anamnesis, clinical examination which consisted of inspection, pharyngoscopy, indirect laryngoscopy and rigid esophagoscopy with following blood tests: number of White blood cell (WBC), total and direct bilirubin, alanine aminotransferase (ALT) and aspartate aminotransferase (AST). 26 patients were excluded from the study (21 patient was not examined by esophagoscopy from various reasons and other 5 had no sufficient blood test results). Blood tests were performed 24 to 48 hours from injury. Rigid instrumentation was used as flexible was not introduced as standard at that time. Esophageal injury was classified by using the Zagar's classification scale. Data were statistically analyzed by Independent Samples T Test.

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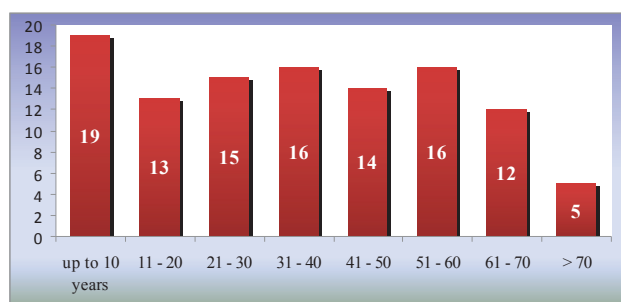
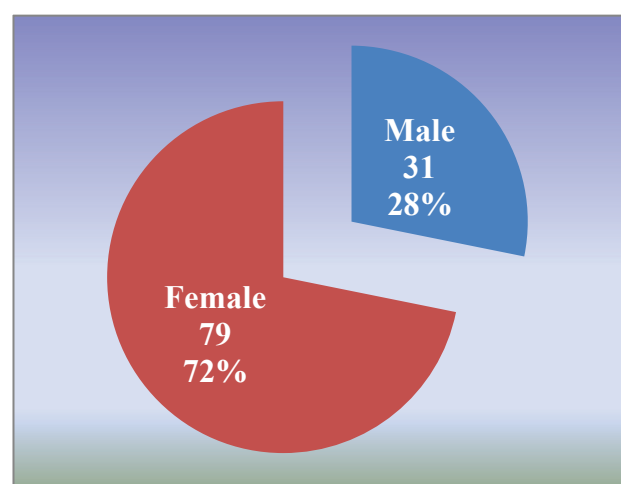
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Competing interests

The authors declare no competing interests.

RESULTS:

We analyzed data of 110 patients that are treated due to corrosive injury of aero-digestive tract. Most of them received the first medical aid in less than six hours and were admitted to the hospital up to 48 hours after injury. 8 patients died due to complications after injury. 13 more patients died in total group (136) but they have no sufficient clinical data for this study. 7 of them have highly elevated levels of WBC, AST, ALT and bilirubin but they were not examined by esophagoscopy so there was no evidence of degree of esophageal injury and other 6 haven't any clinical data.

**Figure 1** Age distribution**Figure 2** Gender distribution

Majority of patients were females (Figure 2). Following data presents the distribution of injuries of the esophagus by its degrees. We used Zagars's classification.

Table 1 Distribution of esophageal injuries by its degrees

Esophageal injury	Number of patients
Grade 0	15
Grade 1	18
Grade 2a	16
Grade 2b	22
Grade 3a	20
Grade 3b	19

Table 2 Blood test mean values for whole group

Blood test values	Mean value	SD
L	10.88	6.711
total bilirubin	19.61	16.928
direct bilirubin	6.50	7.124
AST	50.91	133.816
ALT	65.39	254.507

Table 2 Blood test mean values for whole group

WBC	Mean value	SD
Grade 0	6.97	2.647
Grade 1	7.52	2.508
Grade 2a	7.66	3.048
Grade 2b	10.73	4.463
Grade 3a	11.23	5.918
Grade 3b	19.64	8.891

Table 3 Mean values of L compared to severity of esophageal injury

Correlation	WBC		
	t	df	p
grade 0 - grade 1	-0,610	31,000	0,547
grade 0 - grade 2a	-0,669	29,000	0,509
grade 0 - grade 2b	-2,923	35,000	0,006
grade 0 - grade 3a	-2,861	27,807	0,008
grade 0 - grade 3b	-5,888	21,915	0,000
grade 1 - grade 2a	-0,147	32,000	0,884
grade 1 - grade 2b	-2,868	34,065	0,007
grade 1 - grade 3a	-2,562	26,174	0,017
grade 1 - grade 3b	-5,706	20,993	0,000
grade 2a - grade 2b	-2,376	36,000	0,023
grade 2a - grade 3a	-2,340	29,571	0,026
grade 2a - grade 3b	-5,501	22,841	0,000
grade 2b - grade 3a	-0,311	40,000	0,757
grade 2b - grade 3b	-3,956	25,647	0,001
grade 3a - grade 3b	-3,457	31,117	0,002

Comparison chart (bolded-statistical significance)

Table 3 shows the mean value of number of WBC with comparison chart between groups.

total bilirubin	Mean value	SD
Grade 0	9.45	2.819
Grade 1	14.57	6.302
Grade 2a	12.04	5.332
Grade 2b	18.14	10.461
Grade 3a	20.30	17.701
Grade 3b	39.77	24.800

Table 4 Mean values of total bilirubin compared to severity of esophageal injury

total bilirubin			
Correlation	t	df	p
grade 0 - grade 1	-2,904	31,000	0,007
grade 0 - grade 2a	-1,670	29,000	0,106
grade 0 - grade 2b	-3,701	25,281	0,001
grade 0 - grade 3a	-2,695	20,275	0,014
grade 0 - grade 3b	-5,285	18,588	0,000
grade 1 - grade 2a	1,255	32,000	0,219
grade 1 - grade 2b	-1,270	38,000	0,212
grade 1 - grade 3a	-1,301	36,000	0,202
grade 1 - grade 3b	-4,286	20,437	0,000
grade 2a - grade 2b	-2,134	36,000	0,040
grade 2a - grade 3a	-1,798	34,000	0,081
grade 2a - grade 3b	-4,746	19,958	0,000
grade 2b - grade 3a	-0,488	40,000	0,629
grade 2b - grade 3b	-3,540	23,482	0,002
grade 3a - grade 3b	-2,833	37,000	0,007

Comparison chart (bolded-statistical significance)

In table 4 we presented mean values of total bilirubin with comparison chart between groups.

direct bilirubin	Mean value	SD
Grade 0	2.60	1.118
Grade 1	4.73	2.502
Grade 2a	3.87	1.755
Grade 2b	6.10	3.507
Grade 3a	5.30	2.519
Grade 3b	15.17	13.178

Table 5 Mean values of direct bilirubin compared to severity of esophageal injury

direct bilirubin			
Correlation	t	df	p
grade 0 - grade 1	-3,249	24,422	0,003
grade 0 - grade 2a	-2,382	29,000	0,024
grade 0 - grade 2b	-4,372	26,832	0,000
grade 0 - grade 3a	-4,266	27,697	0,000
grade 0 - grade 3b	-4,140	18,328	0,001
grade 1 - grade 2a	1,152	32,000	0,258
grade 1 - grade 2b	-1,393	38,000	0,172
grade 1 - grade 3a	-0,695	36,000	0,492
grade 1 - grade 3b	-3,390	19,366	0,003
grade 2a - grade 2b	-2,340	36,000	0,025
grade 2a - grade 3a	-1,927	34,000	0,062
grade 2a - grade 3b	-3,701	18,756	0,002
grade 2b - grade 3a	0,846	40,000	0,403
grade 2b - grade 3b	-2,912	20,205	0,009
grade 3a - grade 3b	-3,211	19,250	0,005

Comparison chart for direct bilirubin (bolded-significant p values)

Table 5 shows mean values of direct bilirubin with comparison chart

AST	Mean value	SD
Grade 0	19.89	10.017
Grade 1	22.92	15.445
Grade 2a	19.74	6.505
Grade 2b	44.24	85.874
Grade 3a	23.11	8.530
Grade 3b	165.18	286.829

Table 6 Mean values of AST compared to severity of esophageal injury

AST			
Correlation	t	df	p
grade 0 - grade 1	-0,652	31,000	0,519
grade 0 - grade 2a	0,052	29,000	0,959
grade 0 - grade 2b	-1,088	35,000	0,284
grade 0 - grade 3a	-1,024	33,000	0,313
grade 0 - grade 3b	-2,206	18,056	0,041
grade 1 - grade 2a	0,765	32,000	0,450
grade 1 - grade 2b	-1,037	38,000	0,306
grade 1 - grade 3a	-0,047	36,000	0,962
grade 1 - grade 3b	-2,159	18,110	0,045
grade 2a - grade 2b	-1,135	36,000	0,264
grade 2a - grade 3a	-1,304	34,000	0,201
grade 2a - grade 3b	-2,210	18,022	0,040
grade 2b - grade 3a	1,094	40,000	0,280
grade 2b - grade 3b	-1,771	20,788	0,091
grade 3a - grade 3b	-2,158	18,030	0,045

Comparison chart (bolded-statistical significance)

In table 6 we have mean values of AST with comparison chart.

ALT	Mean value	SD
Grade 0	20.60	10.478
Grade 1	20.61	8.312
Grade 2a	20.87	7.850
Grade 2b	36.56	38.546
Grade 3a	28.83	12.461
Grade 3b	252.51	587.575

Table 7 Mean values of ALT compared to severity of esophageal injury

ALT			
Correlation	t	df	p
grade 0 - grade 1	-0,006	31,000	0,996
grade 0 - grade 2a	-0,081	29,000	0,936
grade 0 - grade 2b	-1,846	25,352	0,077
grade 0 - grade 3a	-2,068	33,000	0,047
grade 0 - grade 3b	-1,720	18,014	0,103
grade 1 - grade 2a	-0,090	32,000	0,929
grade 1 - grade 2b	-1,888	23,361	0,072
grade 1 - grade 3a	-2,412	33,326	0,022
grade 1 - grade 3b	-1,720	18,008	0,103
grade 2a - grade 2b	-1,858	23,357	0,076
grade 2a - grade 3a	-2,337	32,420	0,026
grade 2a - grade 3b	-1,718	18,008	0,103
grade 2b - grade 3a	0,857	40,000	0,397
grade 2b - grade 3b	-1,599	18,134	0,127
grade 3a - grade 3b	-1,659	18,015	0,114

Comparison chart between groups (bolded-statistical significance)

DISCUSSION:

Corrosive injury of aero-digestive tract is a serious medical condition. This condition is treated with general medical therapeutic measures but sometimes we use broad spectrum antibiotics, steroids, nutritive support, and even dialysis in patient with general toxic effects supported by ICU. A total of 110 patients were included in this study. The mean age value was 25, ranging from 1 to 80. Predominant age was up to 10 years [2,3,4]. We found female prevalence (79 female and 31men) [5,6], although some authors had different experience[7]. Degree of esophageal injury in our study was evenly distributed [8]. 25 patients were excluded from blood tests study. 21 were not examined by esophagoscopy. Other 5 patient had no complete blood testing. Blood tests in our study showed different level of reliability to predict patient's condition. As we had mortality rate high as 7,3% in study group and 15,5% mortality rate for all injured [136]. We were thinking of some biochemical predictors for deteriorating general health condition after corrosive injury. Some other investigations showed interest in this subject but still there is no firm data and consensus about these parameters [15, 16, 17]. We noticed that some blood tests values have been found up to 48 hours after injury may have predictive value. Number of WBC was elevated in 2b and 3a group and it is of high statistical significance comparing with the other categories, but most obvious count is in 3b injuries. Total and direct bilirubin with statistic significant difference among uninjured esophagus and all other categories was also a test of indicative value. It makes it the most sensitive test to any degree of esophagus injury [9]. Level of both bilirubin tests are sharply increased in 3b category. Levels of AST and ALT were both extremely increased in patients

with 3b injured esophagus. In both tests we have no significance in category up to 3a injuries but in 3b it rose more than ten times [10, 11, 12, 13, 14]. If we compare death rate we have 6 patients in group 3b one patient in group 3a and one in 2b. All other patients were not examined by esophagoscopy (they died soon after they came to hospital) but 7 of them had number of WBC over 15, 00 and highly elevated AST, ALT and bilirubin.

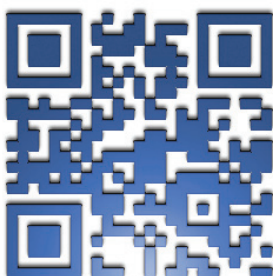
CONCLUSIONS:

Some blood tests have predictive value for estimation of severity of esophageal injury. Most sensitive for any level of injury were total and direct bilirubin. AST and ALT were most predictive tests for 3b grade injury of esophagus with extremely elevated values in those categories. With these prediction results some of additional therapeutic measures may be applied in order to prevent complications with possible death outcome.

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