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The Role of Urgent Esophagogastroduodenoscopy in Prognosis of Acute Caustic Poisonings

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SUMMARY

Introduction: Ingestion of corrosive substances causes severe lesions to the upper gastrointestinal tract. **The aim** of this paper was to present our clinical experience with the 4-grade endoscopic classification of post-corrosive injuries in prognosis of the outcome in acute caustic poisonings.

Material and methods: This was a retrospective study comprising 33 patients with grade II B and III injury hospitalized at the University Clinic for Toxicology in Skopje, Republic of Macedonia in the period 2008-

2009. The grade of injury was determined with urgent esophagogastroduodenoscopy performed in the first 12-24 hours. After treatment the patients were followed for a minimum of six months. **Results:** A total of 33 patients were analyzed. At the time of hospital admission post-corrosive injuries of grade III predominated (n=22, 66.67%) and post-corrosive injuries of grade II B (n=11, 33.33%). The most common late post-corrosive complications of the esophagus was stenosis esophagei (n=19, 57.58%). The most common post-corrosive damages of the stomach were: stenosis antropylori

(n=10, 30.30%), stenosis pylori (n=6, 18.18%) and stenosis antri (n= 3, 9.09%).

Conclusion: Urgent esophagogastroduodenoscopy has to be done in all acute caustic poisonings in the first 12-24 hours and they are to be classified according to Kikendall's four-grade classification. The classification in four grades of post-corrosive injuries to the upper gastrointestinal tract might help in therapeutic approach and prognosis of the outcome.

Key words: caustic poisonings, caustic injuries, esophagogastroduodenoscopy, post-corrosive stenosis.

1. INTRODUCTION

Intoxication with caustic substances occurs by an ingestion of acids (hydrochloric, acetic, sulphuric, lactic, oxalic, carbolic), alkalis (sodium and potassium, soaps, detergents), heavy metal salts (sublimate), formalin, iodine tincture and many other chemical substances (1). Ingestion of corrosive substances causes a wide spectrum of post-corrosive injuries to the upper gastrointestinal tract (GIT) that might be either moderate or fatal and might lead to lifetime handicap (2).

The severity of the chemical burns that appear and affect almost the entire gastrointestinal tract depends on several factors: nature of the corrosive substance, quantity ingested, its concentration, duration of exposure, the act of swallowing (3). Most corrosive poisonings by children are accidental whereas ingestions in adults are with suicidal intent in more than 90% of the cases.

Corrosive substances pass through the GIT and cause severe

damages of the mouth, throat, esophagus, stomach and duodenum. The final outcome of acid ingestion is the so-called coagulation necrosis. In contact with alkalis the final outcome of tissue injury is the so-called liquefaction necrosis (4).

Esophagogastroduodenoscopy is a sophisticated and sovereign method for diagnostic evaluation of acute corrosive poisonings and injuries of the upper gastrointestinal tract. According to the latest controlled studies the most optimal timing for esophagogastroduodenoscopy is the first 12 – 24 hours following corrosive ingestion while according to other authors it may be safely performed within the first 96 hours following corrosive ingestion (5). It gives us useful data on the location, severity and extent of the post-corrosive injuries and the endoscopic classification is of substantial importance for establishing the diagnosis (6, 7).

Esophagogastroduodenoscopy gives us important data on post-

corrosive changes and damages in the upper GIT (esophagus, stomach and duodenum), which provide a thorough evaluation related to other clinical examinations, treatment and prognosis of patients.

The aim of this paper was to present our clinical experience with the four-grade endoscopic classification of the post-corrosive injuries in prediction of outcome of acute caustic poisonings.

2. MATERIAL AND METHODS

This retrospective study included 33 adult patients (>18 years) who were hospitalized and treated at the University Clinic for Toxicology in Skopje, Republic of Macedonia in a two-year period 2008-2009.

We excluded 16 patients (n=16) from the study, with grade I and IIA injuries, according to Kikendall. They were admitted from hospital after 2-7 days. Also 2 patients (n=2) were excluded from the study, because they were with grade IV in-

juries according to Kikendal. These patients were hospitalized in the first 24 hours on the Clinic for digestive surgery, on surgical treatment. In four patients (n=4) we did retrograde intraluminal esophageal dilatation. The following parameters were analyzed: age, gender, intent of poisoning, type of the corrosive substance, severity of the post-corrosive injuries and late complications assessed by esophagogastroduodenoscopy.

Esophagogastroduodenoscopy (EGD) was performed by experienced doctors with the endoscope for upper endoscopy of the type Olympus (Japan) with a diameter of 9,2 mm. In preparation of the patients for easier accomplishment of the procedure, xylocaine gel for local anesthesia was used as well as sedation or spasmolytic medicines.

During EGD, insufflation and retrovisual methods were performed carefully or were avoided if the patients were with more severe clinical picture. The severity of the post-corrosive injuries was classified according to the classification scheme in four grades recommended by Kikendall (Table 1).

I grade: edema and erythema of the mucosa
II A grade: hemorrhage, erosions, blisters, superficial ulcers
II B grade: circumferential lesions
III grade: deep grey or brownish-black ulcerations
IV grade: perforation

Table 1. Classification of post-corrosive injuries according to Kikendall

There are also two more classification, after Hollinger and Fridman (in three grades) and Zargar classification (seven grades).

During clinical follow-up EGD was carried out on admission (12-24 h), 15 days, 25-30 days, three or six months after caustic ingestion. In the patients with severe esophageal stenosis, during the follow-up (during six following months) we did radiological gastrografen examinations on the upper GIT.

The patients were treated with proton pump inhibitors or H² blockers, antibiotics, artificial nutrition until the first endoscopic control in duration of 15-20 days (parenteral or

enteral) because of the esophageal rest (NPO), infusion or symptomatic therapy. Eventual complications of the respiratory tract were seen on chest x-ray; kidney complications by monitoring urea and creatinine, and hepatic complications by monitoring alanine and aspartate aminotransferase.

The results obtained were analyzed with Statistica 7.1 statistical program.

In series with numeric features, the following was determined: average value, standard deviation \pm 95% Con. In, minimal and maximal values of the analyzed parameters.

The difference in certain parameters between three and several samples with numeric features (in deviation from normal distribution) and in series with attributive features was tested with Friedman ANOVA test (χ^2), and the difference between two dependent samples (attributive/numeric features – if there was deviation from the normal distribution) was tested with the Wilcoxon's matched pairs test (Z).

3. RESULTS

This retrospective study comprised 33 patients, of whom 7 (21.21%) males and 26 (78.79%) females. The age of the patients ranged in the interval 42.52 ± 17.37 years, \pm 95.00 confidence interval of 36.36–48.67, the youngest patient being 18 and the oldest 74 years old. The largest number of poisonings (n=31, 93.94%) were suicidal and n=2 or 6.06% were accidental. Hydrochloric acid [HCl] ingested 22 (66.67%) patients, sodium hydroxide [NaOH] 6 (18.18%) patients and concentrated acetic acid [CH₃COOH] 5 (15.15%) patients.

Post-corrosive injuries of the upper GIT verified by endoscopy will be described separately for the esophagus and the stomach at the time of admission, 15 days, 25-30 days, 3 months and 6 months after caustic ingestion.

Esophagitis grade III (n=22, 66.67%) and esophagitis grade II B (n= 11, 33.33%) prevailed among the patients.

Fifteen days after ingestion, the first endoscopic control revealed:

esophagitis (n=18, 54.55% patients), esophagitis grade II B (n=5, 15.15% patients), esophagitis grade III (n=8, 24.24% patients), stenosis esophagei (n=1, 3.03% patient) and normal finding (n=1, 3.03% patient).

The second endoscopic control after 25-30 days revealed: esophagitis (n=3, 9.09% patients), esophagitis grade II B (n=1, 3.03% patient), stenosis esophagei (n=17, 51.52% patients) and normal finding (n=12, 36.36% patients).

Three and six months after ingestion, stenosis esophagei was seen in 19 (57.58%) patients and normal finding in 14 (42.42%) patients.

Analysis of the differences in the findings between separate phases of investigation related to esophageal complications and diagnosed by endoscopy has shown: 15 days after caustic ingestion the number of patients with esophagitis grade III and esophagitis II B was reduced; patients with esophagitis predominated for $Z=3.93$ and the difference for $p<0.001$ was significant in comparison to the finding on admission.

Esophageal stenosis and normal findings were prevailing 25-30 days following caustic ingestion, for $Z=1.93$ and the statistical difference for $p<0.001$ was not significant.

There was no significant difference in the relation admission/3 months and admission/6 months ($p>0.05$).

The following findings prevailed in the gastric injuries at the time of admission: gastritis grade II B was registered in 17 (51.51%) patients and gastritis grade III in 16 (48.48%) patients.

Fifteen days after caustic ingestion gastritis was registered in 18 (54.54%) patients, gastritis of grade II B in 10 (30.30%), gastritis of grade III in 3 (9.09%), stenosis antropylori in 1 (3.03%) patient and normal finding in 1 (3.03%) patient.

After 25-30 days of caustic ingestion, 8 (24.24%) patients had stenosis antropylori, 6 (18.18%) stenosis pylori, 3 (9.09%) stenosis antri, 3 (9.09%) gastritis, 1 (3.03%) had gastritis of grade II B and 12 (36.36%) patients had normal finding.

Three months after caustic ingestion, stenosis antropylori was found

Category	Admission	15 days	25-30 days	3 months	6 months
	n (%)	n (%)	n (%)	n (%)	n (%)
Esophagitis	/	18(54,55)	3(9,09)	/	/
Esophagitis gr.II b	11(33,33)	5(15,15)	1(3,03)	/	/
Esophagitis gr.III	22(66,67)	8(24,24)	/	/	/
Stenosis esophagei	/	1(3,03)	17(51,52)	19(57,58)	19(57,58)
Normal finding	/	1(3,03)	12(36,36)	14(42,42)	14(42,42)
Z (p)	/	3,93(p=0.0000) p<0.001	1.93(p=0.054) p>0.05	1.46(p=0.15) p>0.05	1.46(p=0.15) p>0.05
Gastritis	/	18(54,54)	3(9,09)	/	/
Gastritis gr.II b	17(51,51)	10(30,30)	1(3,03)	/	/
Gastritis gr.III	16(48,48)	3(9,09)	/	/	/
Stenosis antri	/	/	3(9,09)	4(12,12)	3(9,09)
Stenosis antropylori	/	1(3,03)	8(24,24)	9(27,27)	10(30,30)
Stenosis pylori	/	/	6(18,18)	6(18,18)	6(18,18)
Normal finding	/	1(3,03)	12(36,36)	14(42,42)	14(42,42)
Z (p)		2,87(p<0.05)	4,74(p<0.001)	5,01(p<0.001)	5,01(p<0.001)
Total	33(100)	33(100)	33(100)	33(100)	33(100)

Wilcoxon's matched pairs- test (Z), Esophagus (p < 0.01** p < 0.001***) (N.sig.), Gaster (p < 0.05* p < 0.01** p < 0.001***) (Sig.)

Table 2. Endoscopy/ esophagus-stomach

Parameter			Average Rank		Sum of Ranks		Mean		Std.Dev	
Urea	Creatinine	admission	1.89	1.94	62.50	64.00	6.15	77.88	7.67	48.94
Urea	Creatinine	10 day	1.98	2.06	65.50	68.00	5.89	90.67	6.18	107.92
Urea	Creatinine	discharge	2.12	2.00	70.00	66.00	5.32	73.82	1.50	18.91
AST	ALT	admission	1.88	1.95	62.00	64.50	40.79	28.27	79.31	21.03
AST	ALT	10 day	2.12	2.15	70.00	71.00	28.52	31.03	11.76	27.06
AST	ALT	discharge	2.00	1.89	66.00	62.50	24.97	24.03	7.83	16.65

Table 3. Urea, creatinine, AST (aspartate transaminase) and ALT (alanine transaminase) during hospital stay

in the largest number of patients – 9 (27.27%), followed by stenosis pylori in 6 (18.18%) patients, stenosis antri in 4 (12.12%) while normal finding was found in 14 (42.42%) patients.

Six months after caustic ingestion, stenosis antropylori was found in 10 (30.30%) patients, stenosis pylori in 6 (18.18%), stenosis antri in 3 (9.09%) and normal finding in 14 (42.42%).

Analysis of the differences in the findings between separate phases of the investigation related to gastric complications and diagnosed by endoscopy has shown: 15 days after caustic ingestion the number of patients with gastritis grade III and gastritis II B was reduced; patients with gastritis predominated for Z=2.87 and the difference for p<0.001 was significant in comparison to the finding on admission.

Re-assessment at 25-30 days after caustic ingestion showed that prevailing findings were stenosis antropylori and stenosis pylori, which showed a significant difference in

comparison to the finding on admission for Z=4.74 and p<0.001.

Three months after caustic ingestion the prevalent findings were stenosis antropylori and stenosis pylori, which showed a significant difference in comparison to the finding on admission for Z=5.01 and p<0.001.

Six months after caustic ingestion the principal findings were ste-

nosis antropylori and stenosis pylori, which showed a significant difference in comparison to the finding on admission for Z=5.01 and p<0.001 (Table 2).

Analysis of the hospital stay has shown that patients were hospitalized for 24.55±5.23 days ± 95.00 Conf. int. 22.69–26.39, minimum 11 days and maximum 34 days of which 10-15 days they stayed in the Unit for Intensive Care and Treatment.

Days when patients were without oral food intake (esophageal rest – NPO) varied in the interval 10.39±1.49 days, ± 95.00 Conf.int. 9.86–10.93, minimum 8 days and maximum 14 days.

Monitoring of the work of the kidneys revealed no significant difference between the values of urea on admission, on day 10 and on discharge for c²= 0.87 and p > 0.05 (p = 0.65) and for c²= 0.24 and p > 0.05 (p = 0.89) there was no significant difference between the values of creatinine on admission, on day 10 and on discharge.

Monitoring of the work of the liver revealed no significant difference between the values of AST on admission, on day 10 and on discharge for c²= 0.97 and p > 0.05 (p = 0.62) and for c²= 1.21 and p > 0.05 (p = 0.55) there was no significant difference between the values of ALT on admission, on day 10 and on discharge (Table 3).

Friedman ANOVA test (c²) p>0.05

The esophageal endoscopic control after 25 days showed luminal stenosis in 17 patients. After the



Figure 1. Esophageal radiological exam with gastrografin 30 days and 3 months after corrosive ingestion

third month the control showed luminal stenosis in 19 patients. The same findings were found with Radiological gastrografen control on the upper GIT (Figure 1).

Two patients with IV grade injuries were admitted to the Clinic for digestive surgery where they were surgically treated.

4. DISCUSSION

The results obtained in this study have unequivocally justified the use of Kikendall's classification of post-corrosive injuries to the upper GIT in the prognosis of the acute corrosive poisonings. Post-corrosive injuries classified in grade II B and grade III cause stenosis of the esophagus and stomach to a larger percentage in comparison with the post-corrosive injuries of grade II A (9, 10).

In 2003 the American Association of Poison Control Centers reported 22000 caustic poisonings with acids, 50000 with alkalis, 16272 with peroxide, 54300 with bleach and 2322 poisonings with phenols or phenol compounds. It is noteworthy that acute corrosive poisonings constitute 8-10% of the total number of poisonings, 18-80% of the complications (31) and 10-38% of the mortality (11, 12). The data for our country show incidence of 15-18% of the total number of poisonings, 14-27% of the complications, and 4-6% of the mortality (13).

Primary reason for corrosive substance ingestion in our patients was suicidal intention (93.94%) as compared to those who ingested the corrosive substance accidentally (6.06%). These data suggest that the high percentage of late post-corrosive complications (stenosis of the esophagus and stomach, >50%) are a result of the large number of suicidal poisonings that affect larger area and the corrosive agent penetrates deeper in the wall of the damaged tissue. Contrary to our results where predominating patients were those who ingested the corrosive substance with suicidal intent, there are other studies claiming an opposite situation when accidental poisonings are equal to or even more common than suicidal ones (14).

Poisonings with hydrochloric

acid (HCl: n=22, 66.6%) were prevalent in our study contrary to the countries of Europe and the USA where in suicidal or accidental poisoning alkalis substances containing sodium hydroxide of 4% to 5% concentration were more commonly used. These are used as cleansing agents or detergents (15). Acids are rarely abused in the USA and Europe (<5%) but more often in countries such as Taiwan or Mediterranean countries (>40%) (16).

Making a decision on urgent esophagogastroduodenoscopy depends on several factors:

- type of the corrosive substance,
- its quantity,
- the intention of ingestion of the corrosive substance, and
- onset of symptoms following the ingestion.

Numerous investigations have demonstrated that elasticity of the esophageal and gastric wall after caustic ingestion due to small collagen quantity is compromised and that formation of new collagen begins after 15 days.

Recently, many studies have suggested to avoid urgent esophagogastroduodenoscopy in accidental poisonings and in asymptomatic patients because of the possible complications or to avoid this procedure in the period between the 5th and 15th day (17). However, the most convenient timing for performing esophagogastroduodenoscopy is within the first 12-24 hours after ingestion. According to other authors upper endoscopy may be safely performed at least in the first 96 hours after corrosive ingestion (18).

In establishing the diagnosis of caustic poisonings it is of substantial importance the severity of the post-corrosive lesions of the esophagus, stomach and duodenum detected by esophagogastroduodenoscopy. Classification of post-corrosive injuries of the upper GIT may be useful in prognosis of the outcome in acute caustic poisonings. As reported in the literature there are several classifications of endoscopic post-corrosive injuries of the upper GIT (Hollinger, Fridman, Zagar, Kikendall) (19, 20). Use of flexible endoscopic tubes and endoscopic ultrasound

has minimized the eventual perforations of the GIT when performing EGD (21). This study has shown that in patients with >II B post-corrosive injuries according to Kikendall there is a higher risk of developing serious late complications (stenosis and similar) in comparison with the patients with grade II A injuries or other moderate grades of injuries.

Although our patients were treated for post-corrosive burns of severe grade, a large number of them were discharged from the hospital without late post-corrosive complications. The results obtained revealed that more than 50% of the patients were discharged from the hospital with late post-corrosive complications whereas more than 40% were discharged with normal endoscopic and x-ray findings of the esophagus and the stomach. These favourable results may be explained by the continual antacid therapy (proton pump inhibitor and H₂ antagonists), insertion of naso-jejunal tubes and early nutritional support given for 15 or 20 days after caustic ingestion (22).

One comprehensive study comprising 179 patients with caustic poisonings, of which 85 were acid and 94 alkali-based substances, registered an average hospital stay at the Department of Intensive Care and Therapy (10 days) and a large percentage of late post-corrosive complications (27%) out of the total number of examined patients. The conclusion of that study was that the grade and extent of the mucous damage of the esophagus and the stomach after the caustic ingestion were the most important factors for the prognosis, outcome and eventual plan for therapy (23).

Determination of distribution and extent of the post-corrosive injuries of the upper GIT was the aim of the study realized in a 6-year period when a total of 158 patients aged between 14 and 97 years were followed up. Of them, 84 (53%) patients ingested "lye", 21 (13%) nitric acid, 43 (27%) different corrosive substances and 10 (6%) ingested unknown corrosive chemical. Upper endoscopy revealed grade II B injury in 33 (21%) and grade III inju-

ry in 20 (13%) patients. The remaining patients were with grade I injury and without post-corrosive lesions of the esophagus and the stomach. Of the 158 patients, 91 (57.5%) had gastric injury, 72 (45.5%) had esophageal injury and 28 (18%) duodenal injury. Caustic substance was ingested inadvertently by 80 (51%) patients, intentionally by 62 (39%) and from unknown reason by 16 (10%) patients. Eight (5%) of the patients died in the acute phase and 10 (6.3%) needed an immediate surgical intervention. In 66% of the patients there was an onset of late post-corrosive complications (stenosis of the esophagus and the stomach) (24).

During an eight-year period a group of 53 patients was examined in the Istanbul University Hospital. Twenty-nine of the patients were female and 24 male, aged between 15 and 77 years; 59% of them ingested the caustic substance by accident and 41.1% by suicidal intent. Urgent esophagogastroduodenoscopy detected grade II B injury in 14 patients, grade III in 15 patients and 8 (15%) patients had complications such as perforation and acute abdomen. Twenty-five (47.1%) of them ingested acid, 21 (40%) alkali and 7 (12.1) unknown substance. The percentage of late post-corrosive complications of the esophagus and the stomach was high and reached 70% of the total number of patients (25).

These findings are in agreement with the results obtained in our study.

5. CONCLUSION

The results obtained in this study have confirmed that the most optimal timing for esophagogastroduodenoscopy is the first 12 – 24 hours following corrosive ingestion.

Four-grade classification recommended by Kikendall has shown to be a very practical one in defining the severity of the post-corrosive injuries according to the damage in

the wall of the tissue, especially in suicidal poisonings.

Determination of the grade and extent of the lesion helps in prediction of the outcome of caustic poisoning and eventual late post-corrosive complications.

Determination of the grade of post-corrosive lesion and extent of the injury is a useful guide in planning the therapeutic approach.

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