Background: The ingestion of chemical agents, of caustic nature, represents a serious problem for clinical toxicology. If the ingestion doesn’t cause death during the acute period, it will most often cause severe side effects in the upper gastrointestinal tract during the chronic phase. Aims: The purpose of this study is to show the clinical, epidemiological and socio-economical characteristics seen in acute corrosive poisonings such as ingested caustic agents, causes for abuse and most consequential complications. Material and methods: A ten year medical data was constructed and collected (2000-2009) from patients with acute corrosive poisonings who were hospitalized and treated in the University Clinic of toxicology and urgent internal medicine in Skopje, Republic of Macedonia. The variables included were: age, sex, type of poisonings and percentage of late post-corrosive complications. Results: In the study, 735 patients files were analyzed, collected in a period of ten years. The mean age of patients is 32.9±15.6 years. Majority of patients ingested hydrochloric acid (HCl; n=354; 48.16%). Conclusion: Demographic, diagnostic and therapeutic findings in acute corrosive poisonings are found to be similar to the findings observed in the referenced literature. Conclusively, women between 14 and 30 years old represent a high risk group; hydrochloric acid is the most often abused agent; and high percentage of post-corrosive complications are observed. Key words: corrosive substances; esophageal injuries; post-corrosive stenosis; esophagogastroduodenoscopy.
tients who were admitted and treated at the University Clinic of Toxicology and Urgent Internal Medicine, in Skopje, Republic of Macedonia, in the period from 2000 to 2009.

The variables measured and analyzed include: age, sex, type and amount of ingested agent, cause of ingestion (intended or accidental), types of diagnostic procedures used, prominent symptoms, grades of post-corrosive injuries, early and late post-corrosive complications.

Patients in the acute phase were hospitalized in intensive care and underwent urgent esophagogastroduodenoscopy in the first 24 hours. The post-corrosive injuries were categorized according to Kikendall classification (Table 1).

The standard of procedure, for patients with intentional ingestion, is psychiatric evaluation prior to hospital release.

Esophagogastroduodenoscopy was performed by experienced medical staff with flexible endoscope, type Olympus (Japan) with a diameter of 9.2mm. During the preparation of our patients, prior to the procedure, we used xylocaine gel for a better accomplishment of this invasive method. Techniques such as insufflations and retrovisuisation were performed very carefully due to the high risk of iatrogenic injuries. The quantity of ingested corrosive agent was determined by data carefully gathered through the form of a questionnaire, filled out by the patients and/or their families. Patients were asked to compare the amount of ingested chemical substance with one tablespoon, assuming that one tablespoon contains 15 ml. Symptoms presented at admission were noted in patients’ clinical charts and according to the severity of the clinical presentation the poisonings were classified as simple, mild and severe. Patients who were admitted to hospital within 3 hours after the ingestion (n=440; 59.86%; p<0.001) and most of the patients abused the corrosive agent with suicidal intentions (n=691; 94.01%; p<0.001) (Table 3).

Hydrochloric acid was most commonly used substance (HCl; n=354; 48.16%), while sodium hydroxide and sodium hypo chloride were used in lesser number of cases (NaOH; n=135; 18.36%; NaClO; n=149; 20.27%). Distribution illustrates that the majority of patients ingested hydrochloric acid (p<0.001).

Urgent esophagogastroduodenoscopy (EGD) showed that at admission most of the patients are with IIA grade of injuries (n=230; 31.29%) and IIB (n=213; 28.97%) (p<0.01), although at discharge the greater number of patients are with normal EGD findings (n=516; 70.20%) (p<0.01). Unwanted outcome was reported in n=51 or 6.9% of the patients.

Most of the patients presented the poisoning with mild clinical presentation (n=380; 51.7%) (p<0.001) (Table 4).

RESULTS

In this study we evaluated 735 patients’ charts for a 10 year period, from 01.01.2000 to 31.12.2009. Table 2 shows all clinical and demographic characteristics of our patients, year by year. The mean age ranges between 32.9±15.6 years (mean ± SD), where the majority of patients are females (n=524; 71.29%), and the minority are males (n=211; 28.7%). Minimum age is 15 years, while maximum is 80 years. Highest education of patients ranks down as follows starting from the greatest percentage as secondary education (n=445; 60.68 %), followed by elementary school education (n=263; 35.78 %), and the least post-secondary education (n=26; 3.53 %).

According to their religious affiliation the majority were orthodox (n=385; 52.38%), Muslim (n=345; 46.93%), and others (n=5; 0.68%). Our investigation showed that the greater number of patients ingested between 5 and 10ml (n=482; 65.57%) of the chemical substance, the amount ranged between 16.8±8.6ml, whereas minimal quantity was 5, and maximal 50ml. The majority of patients were admitted to hospi-
Clinical and Epidemiological Features of Acute Corrosive Poisonings

Table 2. Clinical and demographic characteristics

Although similar findings can be seen among children. Data from a study conducted in England, Wales, suggests that one third of the total number of recorded poisonings is caused by household cleaning supplies (13).

Corrosive poisonings may cause serious post corrosive injuries of the upper gastrointestinal tract, along with very significant variables that can magnify the results such as age, gender, amount of ingested substance, duration of exposure, time interval between beginning of the treatment and evaluation of the damages with urgent endoscopy (14).

In our study the ratio between females and males is 2.5:1. Dominance of women who ingested corrosive agents, due to various reasons, is confirmed in number of other studies made in different part of the world including Asia and Latin America (15, 16).

Age analysis showed that the majority of patients are between 14 and 30 years of age, which that the highest risk group represents the developing population in the most productive and effective period.

A research made in Taiwan illustrated that the greater number of patients are with a mean age of 40 years and that among younger patients late post corrosive injuries and complications are more often and more severe (17).

Nontable of registered corrosive poisonings is positively correlated with patients educational degree. Poisonings are more often recorded in individuals with lower educational degree and in the rural part of the country, where corrosive agents are also not controlled legally. The data implies that patients with elementary or secondary education at most, are the ones to resort to corrosive agents and poison them selves with them. Unlike patients with post-secondary education such as university degrees, who number is almost insignificant.

Same studies made in Brazil and Turkey showed that the number of corrosive poisonings is greater in the rural areas in which the corrosive substances are used more often during every day life and where the public regulative is not appreciated (18).

In Macedonia, which is multi-confessional country, there is no difference between Christians and Muslims; despite the religion all individuals may

| Table 3. Ingested amount, moment of hospitalization and motive for the poisoning |
|---------------------------------|-----------------|-----------------|-----------------|
| Type of corrosive agent | Amount (ml) | Hospitalization | Motive |
| | n (%) | 5-10 | 10-30 | > 30 | After 1-3 | After 3-6 | After > 6 | n (%) | n (%) |
| HCl | 354 | 48.16 | 11.29 | 20.27 | 0.81 | Normal findings | 516 | 64 | 56 | 48 | 51 |
| NaOH | 135 | 18.36 | 11.29 | 20.27 | 0.81 | Stenosis oesophageal | 70.20 | 8.7 | 6.53 | 6.9 |
| H2SO4 | 83 | 11.29 | 20.27 | 0.81 | Stenosis ventricular | 70.20 | 8.7 | 6.53 | 6.9 |
| NaClO | 149 | 11.29 | 20.27 | 0.81 | Stenosis oesophageal et ventricular | 70.20 | 8.7 | 6.53 | 6.9 |
| H2O2 | 6 | 11.29 | 20.27 | 0.81 | Exitus letalis | 70.20 | 8.7 | 6.53 | 6.9 |
| p < 0.01 |

| Table 4. Type of corrosive agent, clinical findings at admission and discharge and severity of the poisoning |
|---------------------------------|-----------------|-----------------|-----------------|
| Type of corrosive agent | Injuries of upper GIT at admission | Severity of the poisoning |
| | n (%) | n (%) | n (%) |
| HCl | 354 | 48.16 | 11.29 | 20.27 | 0.81 | Normal findings | 516 | 64 | 56 | 48 | 51 |
| NaOH | 135 | 18.36 | 11.29 | 20.27 | 0.81 | Stenosis oesophageal | 70.20 | 8.7 | 6.53 | 6.9 |
| H2SO4 | 83 | 11.29 | 20.27 | 0.81 | Stenosis ventricular | 70.20 | 8.7 | 6.53 | 6.9 |
| NaClO | 149 | 11.29 | 20.27 | 0.81 | Stenosis oesophageal et ventricular | 70.20 | 8.7 | 6.53 | 6.9 |
| H2O2 | 6 | 11.29 | 20.27 | 0.81 | Exitus letalis | 70.20 | 8.7 | 6.53 | 6.9 |
| p < 0.01 |
abuse corrosive substance. According to religious affiliation we found difference in usage of various corrosive agents like acids or alkalis, which are used for various sanitary purposes or within the food production industry. (19).

The amount of ingested corrosive substance, time interval between moment of ingestion and admission to hospital, also the intention for the abuse are of great importance for prognosis of the poisonings’ outcome. In our group of patients the ingested amount was between 5 and 10ml, time interval was between 1 and 3 hours and the intention was mainly suicidal. The motive for corrosive substance abuse is often related to the amount of ingested agent. Usually when the substance is taken due to a suicidal intention the amounts are always large, despite the situations when ingestion happened accidentally and the amounts are generally quite lower. Among children poisonings are always accidental, but in adult population they are usually suicidal. According to information from different countries, the motive for corrosive agents abuse depends on development of the country and patients’ educational structure. In countries which are on a low developmental level and among patients with lower educational degree poisonings are generally with suicidal intentions. On the other hand, patients with high educational degree and in high developed countries ingested the substance accidentally (20).

Percentage of late post corrosive complications is directly related to the amount of ingested chemicals and time interval between moment of ingestion and admission to hospital. Occurrence of stenosis of the upper gastrointestinal tract depends on quantity of ingested corrosive substance and time interval between admission to hospital and initiation of the treatment (21, 22).

We are determined that intake of 5 to 10ml can cause mild damages of the upper GIT, while amount of 10 to 20ml can cause serious post corrosive injuries. Intake of 30ml or more can end lethally during the acute phase, if not it will cause serious post corrosive complications and long term disability. One study, illustrated that the ingestion of 50ml causes very serious and fatal post corrosive injuries, despite amounts like 15-30ml and less that cause mild and severe damages (23).

Our survey showed that most often abused corrosive substance is hydrochloric acid, less frequent sodium hydroxide and sodium hypochlorite. Similar studies around the world demonstrated that in European countries and USA we usually see poisonings which are result of ingestion of bases, which are found in cleaning products. On the other hand among countries like Macedonia or India poisonings are due to acids abuse, also used in households (24).

In our group of patients the poisonings are generally mild (presented with hyper salivation, difficulty in swallowing, pains in mouth, throat, and behind the sternum, nausea), the grades of post corrosive injuries usually are IIA and IIB, according to Kikendall classification, and most often the patients experience complete recovery. Current treatments (antibiotics, proton pump inhibitors, H₂ blockers, intensive hyper alimentation and esophageal rest) help us achieve complete recovery and healing while decreasing the percentage of late post corrosive complications.

Golden standard among diagnostic procedures is the urgent esophagogastroduodenoscopy performed in the first 12-24 hours after the poisoning. Despite documented clinical signs the endoscopic result is of a great importance in localizing of the post corrosive damages and determination of their deepness. However, when there are signs of esophageal or gastric perforation, performing upper endoscopy is not obligatory. Urgent esophagogastroduodenoscopy has become the main and safest diagnostic procedure which can be used in treatment planning and provides some predictions for the potential post corrosive complications and mortality rate (25, 26). Results from many different studies showed that the severity of the injuries is correlated with the type of corrosive agent, its concentration, time of exposure and reason for ingestion(accidental or suicidal) (27, 28).

Corrosive substances cause tissue destruction as a result of coagulative and colliquative necrosis. We still report high percentages of late post corrosive complications, between 15% and 85%. The mortality rates are still high, despite the intensive therapy, effective care, sophisticated diagnostic and therapeutically approach. Literature reports different numbers for mortality rates in the interval 2-10%. Greater number of studies, created in order to evaluate the severity of post corrosive complications, showed that despite the high risk in the acute phase, the poisoning may end fatally even during the chronic phase as a result of malnutrition. Regardless of decreasing number of post corrosive injuries, we still have patients with very serious and severe damages of the upper GIT and they often end with life-long disabilities (29, 30).

5. CONCLUSION

Women seem to abuse corrosive agents twice as much as men. Poisonings can be seen in every age, but most often they occur between young people, in the most effective and most creative period of their lives. They can happen in every religious group and are more often seen among people with low educational degree. Amount of ingested agent, time interval between moment of ingestion and admission to hospital, also the motive for chemicals abuse, remain important features which determine the severity of the poisoning and its outcome. Endoscopic evaluation at admission, during hospitalization and after discharge remains the golden standard for diagnosis, choice of treatment and prognosis of the poisoning.

Unfortunately, despite modern therapeutically protocols, usage of sophisticated methods for diagnosis and treatment, the high percentage of post corrosive complications is still a great challenge for doctors who follow and treat this problem.

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