Challenges in diabetic foot treatment during pandemic of COVID-19

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ABSTRACT

The objectives: To avoid hospital spread of Coronavirus-2019 (COVID-19) and to analyze out of hospital outcomes after amputation.

Methods: Prospective analysis of data obtained from 60 diabetic patients in 2020 was performed at Cantonal Hospital Zenica, Zenica, Bosnia and Herzegovina. Personal protection equipment included double surgical mask, glasses, disposable surgical coats, and surgical masks for patients. Swabs were used to take samples from wounds. We randomly divided patients in 2 groups of 30 patients each. In preoperative treatment, we used local anesthesia lidocaine hydrochloride 2% (Belupo, Koprivnica, Croatia) in group A and systemic analgesia intravenous tramadol chloride 100 mg intravenous (Krka, Novo Mesto, Slovenia) in group B. Wounds were surgically treated each day and heal spontaneously. Periodical control exams were performed.

Results: Wound healing did not present any statistically significant differences between groups (group A: 69±21.97 and B: 61±22.13 days, t=-1.22; p=0.11). No statistically significant differences (p<0.05) between groups A and B in wound healing regarding to gender or cigarette use was noted.

Conclusion: No significant differences in amputation treatment between the 2 comparative groups were noted. No confirmed COVID-19 infections in medical staff who performed surgical interventions or in treated patients were detected.

Keywords: diabetic foot, amputation, COVID-19
Our hospital is small with limited resources, and the total number of anesthesiologist specialists is 12. Until now, 7 anesthesiologists were infected with Coronavirus-2019 (COVID-19) and presented with severe clinical condition. For our hospital, every day is a challenge to provide sufficient medical care to patients. Due to insufficient testing resources, we have lesser possibility of confirming the COVID-19 infection in patients from Canton Zenica-Doboj (area of 3,343.3 km², population 360,093 [119 citizens/km²]).

Morbidity due to diabetes mellitus in 2016 was 336.5/10,000, and in 2017, it was 324.3/10,000 citizens. Among the 5 leading diseases in 2017, hypertensive diseases had 13% of the total registered diseases with a disease rate of 1,217/10,000 inhabitants, and diabetes mellitus had a share of 3.7% with a disease rate of 349/10,000 inhabitants.

The fifth most common cause of death in women in 2017 was insulin-independent diabetes mellitus at a rate of 51.8 per 100,000 citizens. Among the 5 leading diseases in 2017, hypertensive diseases had 13% of the total registered diseases with a disease rate of 1,217/10,000 inhabitants, and diabetes mellitus had a share of 3.7% with a disease rate of 349/10,000 inhabitants.

The study was prospective, descriptive-analytical, comparative, randomized, and conducted in the vascular laboratory ambulance of Cantonal Hospital Zenica, Zenica, Bosnia and Herzegovina between January 2020 and September 2020. The ethical approval was obtained from the Ethical Committee of Cantonal Hospital Zenica. The inclusion criteria for patients were: diabetes mellitus, foot finger gangrene (wet or dry) with or without phlegmona and neurotrophic wounds. Exclusion criteria were: non diabetic patients, patients with malignant disease, foot traumatic injuries and burns.

All procedures performed in the studies involving human participants were in accordance with the ethical standards of the institutional or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Methods. The study was prospective, descriptive-analytical, comparative, randomized, and conducted in the vascular laboratory ambulance of Cantonal Hospital Zenica, Zenica, Bosnia and Herzegovina between January 2020 and September 2020. The ethical approval was obtained from the Ethical Committee of Cantonal Hospital Zenica. The inclusion criteria for patients were: diabetes mellitus, foot finger gangrene (wet or dry) with or without phlegmona and neurotrophic wounds. Exclusion criteria were: non diabetic patients, patients with malignant disease, foot traumatic injuries and burns.

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During amputation, all patients had surgical masks that covered their mouths and noses. Patient heads were separated from the surgeon with a cotton cloth. All medical staff had surgical masks, visors, and disposable surgical uniforms. After interventions, we used chlorine solution and ultraviolet (UV) lamps for disinfection. The polymerase chain reaction (PCR) test for COVID-19 in patients was not performed.

**Statistical analysis.** All results were analyzed by the statistical program SPSS version 16 (SPSS Inc. Released 2007. SPSS for Windows, Version 16.0. Chicago, SPSS Inc). The results were analyzed using t-test and HI2 test for comparison between the investigated groups. The degree of correlation was tested using the correlation coefficient Pearson or Spearman. Finally, it would apply the appropriate models of regression analysis to determine the independent association of variables. Values of \( p<0.05 \) will be considered statistically significant.

**Results.** No statistically significant differences in age between groups (standard deviation: group A=11.74, group B=12.25) were noted as shown in Figure 1. Wound healing tendencies did not show statistical significance difference between groups (standard deviation [SD]: group A 21.97, group B 22.13, \( t=-1.22, p=0.11 \), Figure 2). Two patients, one in each group, completed treatment with amputations above knee.

No statistical differences in glycosylated hemoglobin (HbA1c) findings between group A and B: mean 8.83 versus 8.89 (SD: group A=2.01, group B=1.56), standard error 0.37 versus [vs.] 0.29 (\( p<0.05 \)). Four patients in group A and 3 patients in group B did not have HbA1c measurements. No statistically significant difference (\( p<0.05 \)) between groups A and B in wound healing with respect to gender (\( t=-1.09, p=0.15 \) vs. \( t=-0.27, p=0.39 \)), cigarette use (\( t=-1.05, p=0.15 \) vs. \( t=-0.73, p=0.23 \)), first amputation (\( t=0.39, p=0.35 \) vs. \( t=-1.32, p=0.09 \)), dry gangrene (\( t=-0.25, p=0.39 \) vs. \( t=-0.93, p=0.18 \)), wet gangrene (\( t=-0.93, p=0.18 \) vs. \( t=0.26, p=0.40 \)), antibiotics (\( t=1.17, p=0.12 \) vs. \( t=0.39, p=0.34 \)), insulin therapy (\( t=-0.87, p=0.22 \) vs. \( t=-0.9, p=0.04 \)), antibiotic therapy (\( t=-0.64, p=0.27 \) vs. \( t=-1.27, p=0.1 \)).

**Discussion.** We confirmed in our study that the main variables were postoperative wound care (dependent on personal professionalism of medical nurses), social, and living conditions. We did not measure the possible pain that the patient felt. In addition, toxicity of local anesthetics and their influence on increasing unwanted

| Table 1 - Patient genders, risks, therapies, and local findings. |
|-------------------------|-----------------|-----------------|
| Variables                | Group A         | Group B         | Total           |
| Female                   | 21 (63.3)       | 19 (70.0)       | 40 (66.7)       |
| Cigarette smoking        | 13 (36.7)       | 18 (60.0)       | 31 (51.7)       |
| Insulin                  | 23 (76.7)       | 21 (70.0)       | 44 (73.3)       |
| ACE inhibitors           | 24 (80.0)       | 27 (90.0)       | 51 (85.0)       |
| Statins                  | 23 (76.7)       | 29 (96.7)       | 52 (86.7)       |
| Antithrombotics          | 27 (90.0)       | 30 (100)        | 57 (95.0)       |
| Antibiotics              | 26 (86.7)       | 26 (86.7)       | 52 (85.0)       |
| Dry gangrene             | 8 (26.7)        | 7 (23.3)        | 15 (25.0)       |
| Wet gangrene             | 22 (73.3)       | 23 (76.7)       | 45 (75.0)       |
| First amputation         | 18 (60.0)       | 20 (66.7)       | 38 (63.3)       |
| Fingers re-amputation    | 8 (26.7)        | 1 (3.3)         | 9 (15.0)        |

Values are presented as numbers and percentages (%). No significant difference between groups with respect to gender, risks, therapies, or local findings were noted.
outcomes after foot finger amputations compared to the comparative group were not confirmed.

Diabetic nerves are more sensitive to local anesthetics, toxicity, and increased possibility of infection using nerve catheter. In general, doses and concentrations of local anesthetics administered in clinical practice today are lower than before; nonetheless, Yu et al confirmed that although small, risk of local anesthetic toxicity, even in healthy nerves, exists.

We still need to be aware of side effects and complications of local anesthetics, such was found in a 63-year-old female with history of smoking abuse, who after an injection of lidocaine with epinephrine, developed necrosis distal phalanx of 2 fingers that required amputations. Regardless our study results, we suggested that using local anesthetics in preoperative preparation for finger amputation is safer and desirable, although we cannot confirm antimicrobial effects of 2% lidocaine hydrochloride and its role on better healing process.

In conclusion, our research goal was due to the COVID-19 pandemic to explore amputation outcomes performed with limited resources. We also observe risk and possibility of COVID-19 contamination and infection of medical staff and patients. We observed and found that after use of local anesthetics versus intravenous analgesia there were no significant differences between groups in healing outcomes. Healthcare services that we provide are far from ideal and sufficient, but we need to be aware that we must provide medical service to help diabetic patients in every way possible considering our resources. No confirmed cases of COVID-19 infections on medical staff who performed surgical interventions or patients who underwent treatment.

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References