

Treatment Cost of Patients with Maxillofacial Fractures at the University Hospital in Mostar 2002–2006

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ABSTRACT

The aim of this study was to establish the costs structure of medical treatment for the patients with maxillofacial fractures, to perform a treatment cost evaluation, describe the factors which considerably influence the costs and discover the ways of achieving financial savings in treated patients. The study group consisted of patients with maxillofacial fractures who were admitted and treated at the Department of Maxillofacial Surgery of the University Hospital Mostar in the period from January 2002 until December 2006. Data for the study were collected from the patients' databases, case histories and data obtained on the basis of individual payments for the treatment that was collected by Finance Department of the University Hospital of Mostar. Most patients in this study were men (83%), of average age 34±19 years. Zygomatic bone fracture was the commonest injury. Open surgical procedure was performed in 84.7% of treated cases. The costs for the open procedure were considerably higher than conservative treatment. Medication cost made up a total of 37.9% and cost of hospital accommodation 27.3% out of total hospital charge. Cost reduction in treated patients with maxillofacial fractures should be achieved through protocols of urgent treatment of maxillofacial trauma patients immediately after sustaining an injury and with earlier discharge of the patients when postoperative complications are not expected.

Key words: maxillofacial injuries, jaw fractures, zygomatic fractures, surgical procedures, jaw fixation techniques, cost analysis

Introduction

Head and neck injuries represent 30% of all injuries of human body and among them almost a half are injuries of the face¹. Maxillofacial fractures in total human pathology have an incidence of 18–32 per 100,000 of all hospitalized patients². The most often injured are men from younger adult group, encompassing those 20 to 40 years old^{3–8}, and most frequently broken facial bone is the mandible^{4,9,10}. Earlier studies revealed that maxillofacial fractures in developed countries arise most often as a consequence of road traffic accidents (60%), which was reduced by wider use of seat belts^{3,4,11}. Most frequent causes of facial fractures in high income countries (as contrasted to those with low income) are assaults and in-

terpersonal violence^{3–7,10,11}. High alcohol intake is often indirect cause of injuries of the head and neck^{5,12}. The most often cause of head injuries in children are frequent falling and abuse at school among peers^{10,11}.

Maxillofacial fractures can be treated by open and closed techniques. Closed reduction techniques implicate reposition and immobilization of the fracture by intermaxillary (IMF) or monomaxillary fixation (MMF). Surgeons make osteosynthesis of broken bone using open reduction techniques, by extraoral or intraoral access, with plates or wire^{2,13}. Selection of appropriate technique of fractured bones treatment depends on surgeon education

and on economic situation in country or region. While the fractures of facial bones in Nigeria are mostly treated by closed techniques, at the same time in Canada the preferred way of treatment is open reduction technique^{4,14}.

Costs of medical treatment in the world continually increase as a result of number of economic and social factors. A high cost of health care burden national economies whose main goal is to reduce health care participation to 5% of national product^{15,16}. Health care cost has been widely stimulated for decades in Bosnia and Herzegovina before independence has been proclaimed. Money transfer for the health care was being realized after its completion. In Bosnia and Herzegovina after independence a prospective mode of reimbursement of expenses was introduced in which medical charge for treatment is previously contracted and amount of money limited. Physicians are expected to behave like managers, to make plans for proper quality treatment which is at the same time economically profitable, because with their decision on how to treat a patient the physicians immediately influence up to 35% of total treatment cost¹⁷.

Majority of treatment costs consist of the so-called »hospital costs« which comprise costs of hospital accommodation and medication that consequently increase with duration of treatment¹⁸. One day of hospitalization makes 2.4% of total treatment cost¹⁹ and it becomes more important item, when it is well known that average length of hospitalization for patients with maxillofacial fractures in the world takes between 7.5 and 9.8 days²⁰. Selection treatment technique for fractured bones directly implicates the cost of treatment, so that in the USA mandible fracture treatment cost when using closed technique is 10,927 \$, whereas an opened treatment technique of mandible fracture costs 34,636 \$²¹. When we take into account advantages of open treatment techniques which mainly imply faster recovery and higher quality of life, differences in costs of treatment become negligible.

The aim of this study was to determine the total treatment cost of patients with maxillofacial fractures, its structure and factors which remarkably influence its price formation, and ways for money savings in treatments of patients with face fractures.

Materials and Methods

This study deals with patients who suffered from maxillofacial fractures inflicted in the period between the 1st January 2002 and 31st December 2006, and were treated at the Department of Maxillofacial Surgery of the University Hospital in Mostar. Nasal bone fractures were not included in this study because they have been usually treated at the Department of Otolaryngology. All following data for this research were collected from medical histories, hospital registers and individual treatment costs that were received from Hospital Finance Department. Finished data base contains some information related to patients according to age and gender, bone fracture (type of fracture and mode of its treatment) and treatment

cost. Treatment cost for every patient was based on total cost and structured as a sum of costs of hospital accommodation, medication, diagnostic tests, and surgery treatment with anesthesia. Costs are in Euros (€). Proportions of variables were tested with Kolmogorov-Smirnov test. Median and interquartile diameter was used for description of middle values and for measurement of dispersion of continuity data with asymmetric distribution. For comparison of three or more continuity variables, because of data asymmetry, Kruskal-Wallis test was used, and for comparison of two continuity variables Mann-Whitney U-test was used. For comparison of two continuity, asymmetric, and subordinate variables Wilcoxon test was used. Spearman's ρ -coefficient of correlation was used for description of correlation continuity variables. For different division of nominal and ordinal variables χ^2 -test was used, and in deficit of expected frequency Fisher exact test was used. The application SPSS for Windows (version 13.0, SPSS Inc, Chicago, Illinois, SAD) and Microsoft Excel (Version 11, Microsoft Corporation, Redmond, WA, SAD) were used for statistic analysis.

Results

This study is dealing with maxillofacial fractures in 113 patients who had been treated at the Department of Maxillofacial Surgery of the University Hospital Mostar for period of five years. For 15 patients in this study we did not have complete health information and we had to exclude them from research.

Median age of patients in this study was 34 years with interquartile diameter of 19 years. The youngest patient was 6, and the oldest 82 years old. The most frequently injured were patients aged between 26 and 50 years (54.1%), and the least frequently injured were those above 50 years (15.3%) ($\chi^2=22.4$; $p<0.001$). Majority of patients were men 82.7% ($\chi^2=41.8$; $p<0.001$).

Fracture of zygomatic bone has been diagnosed in 52 patients (53,1%), the following were fractures of mandible (27.6%), fractures of maxilla (11.2%), and the least frequently occurred were multiple maxillofacial fractures with frequency of 8.2% ($\chi^2=49.7$; $p<0.001$).

Regarding the type of medical treatment 83 patients (85%) were treated with open reduction methods and 15% of patients were treated with closed reduction methods ($\chi^2=47.2$; $p<0.001$). Patients treated with closed methods have had average time of hospitalisation of 7.00 ± 2.00 , and those treated with open methods 11.00 ± 6.00 days (Mann-Whitney U-test=222.5; $p<0.001$). In both groups the patients were hospitalised on average three days before operation. Average postoperative care period for patients treated with closed methods was 2.00 ± 4.00 , and for those treated with open methods 6.00 ± 2.00 days (Mann-Whitney U=88.5; $p<0.001$). The patients with maxillary fractures had the longest hospitalization period of 15.00 ± 7.00 days, than follow the patients with multiple fractures 13.00 ± 11.00 days, fractures of zygomatic bone 10.00 ± 5.00 , and the hospitalization for pa-

tients with mandible fractures lasted 9.00 ± 5.00 days (Kruskal-Wallis = 15.3; $p=0.002$).

Treatment cost for all patients with maxillofacial fractures in this study was 152,796.29 €. The biggest part in total cost belongs to the medication cost as well as the cost of osteosynthetic materials 57,920.2 (37.9%), following is the cost of hospital accommodation 41,696.95 (27.3%), diagnostic tests 28,237.62 (18.5%), and costs of surgical treatment altogether with anesthesia which were in total 24,941.51 (16.3%).

Total cost of treatment using open reduction methods was two times higher than cost of treatment for patients treated with closed reduction methods (Mann-Whitney $U=2.0$; $p<0.001$). While the participation cost in setting of IMF was relatively highest in the total treatment cost, for patient treated with open methods it has summed up to 246.80 ± 35.69 € and had the least participation in total cost of treatment which is $1,344.61\pm 574.93$ €.

The difference in prices between two types of treatments is a result of different costs of medication and implanted osteosynthetic materials which resulted for patients treated with closed reduction methods in 97.36 ± 71.48 € and for the open reduction methods 515.51 ± 493.14 €. The prices for certain types of facial bone fractures are different for particular patients and highest noticed in patients with multiple fractures (Kruskal-Wallis test; $p<0.001$) (Table 1).

Regarding the overall structure of the treatment costs for particular kinds of facial fractures predominant are costs of medication and implanted osteosynthetic materials, the costs of hospital accommodation and the smallest participation in total treatment costs has surgical treatment together with anesthesia and diagnostic procedures.

Discussion

Health care cost participation within national products worldwide is in constant progress¹⁵. Physicians are expected to take serious part in treatment costs reduction because they can directly influence with their decisions up to 35% of total treatment cost¹⁷. From independence of Bosnia and Herzegovina in 1992, the prospective system of reimbursement for medical treatment expen-

ses has been imposed in which all hospital throughout the country have limited amount of financial resources. This system requests from physicians to consciously and precisely make plans in order to effectively coordinate all the therapeutic procedures²².

Most patients with maxillofacial fractures in this study were aged 30, which is identical with sources obtained in worldwide literature³⁻⁸. This population is the most active, aggressive and therefore much more likely to be involved in different types of injuries, including road traffic accidents, interpersonal violence and physical assaults^{6,7}. This research did not take into account ethological factors as a causative of facial bone fractures. This could be a drawback for this presentation. Although the most frequently found worldwide are mandible fractures, followed by zygomatic bone fractures, in our case the results of this study point out almost double higher frequency of zygomatic bone fractures occurrence. There are two possible reasons for such results. Patients who suffered fractures in road traffic accidents, especially younger man, who wish to show off, most often under influence of alcohol^{5,12}, frequently do not buckle up while driving, which results in overall increase in body traumatism, especially the one related to middle face fractures^{4,23,24}. The second most important causative factor of zygomatic bone fractures are violence and assaults which are well known to be a part of aggressive behavior more often noticed in developing countries such as Bosnia and Herzegovina^{6,7,10}.

The most often employed method of open surgical reduction treatment for the patients with maxillofacial fractures in our region is exactly the same as the type of treatment used in developed countries¹⁴. Treating patients in this way is considerably more expensive but, it is at the same time less expensive when looking back to the savings made for the family and employer because the patient's recovery time will be shorter and he/she will be fit for work in considerably shorter period of time, not to mention achieving higher quality of life²¹. Apart of all above mentioned, conservative methods of treatment should be the choice of treatment whenever it is possible to use this type of treatment.

TABLE 1
TREATMENT COST STRUCTURE RELATED TO THE TYPE OF MAXILLOFACIAL FRACTURE

Costs	Type of fracture – median (\pm interquartile range) **				p*
	Zygomatic bone fractures	Maxillary fractures	Mandibular fractures	Multiple fractures	
Medication/materials	437.10 \pm 314.47	1067.86 \pm 997.23	343.03 \pm 345.8	1108.98 \pm 1624.29	<0.001
Operation/anesthesia	246.8 \pm 10.77	246.8 \pm 45.23	237.26 \pm 8.31	285.41 \pm 53.44	0.001
Diagnostic tests	254.92 \pm 130.36	255.08 \pm 238.90	169.85 \pm 60.61	374.20 \pm 629.77	<0.001
Accommodation	291.38 \pm 105.54	420.61 \pm 173.85	283.90 \pm 155.08	407.69 \pm 473.15	<0.001
Total	1254.44 \pm 471.00	2086.33 \pm 1302.78	1061.62 \pm 349.44	2402.4 \pm 3371.32	<0.001

*Kruskal-Wallis test, **Costs are in Euros (€)

Treatment cost for patients which were included in this study was getting higher as a result of longer hospital stay. Comparing the patients with the same diagnosis treated in other countries which spend on average 7.5 to 9.8 days at hospital²⁰, patients in this study were hospitalized for a longer period of time for the same treatment: between 9 and 15 days. Long term hospitalization increases the costs of hospital accommodation and medication, and at the same time relatively reduces costs of operative treatment. Physicians are expected to make better treatment plans and prompt diagnostic procedures in order to shorten up hospital accommodation, and as soon as patient gets better to have him/her discharged to homecare or transferred to hospitals which can offer basic medical care²². All this can be done only in cases when we do not expect any postoperative surgical complications¹⁹. All physicians with necessary and appropriate medical knowledge and skills with professional attitudes to economic aspects in medicine can directly influence hospital treatment costs. Such a professional understands the mechanism of the factors which can influence the hospital costs, so he/she can make plans for cheaper methods of medical treatment which will at the same time provide the highest quality medical attention to patients.

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Conclusion

1. Most patients with maxillofacial fractures were around 30 years of age.
2. The most frequent maxillofacial fractures are zygomatic bone fractures.
3. Although the open reduction methods with osteosynthesis were more expensive, it was the most frequently used medical treatment.
4. Difference in treatment cost between open and closed reduction methods becomes less significant when we take into account the savings related to earlier return to work, lowered expenses for the family and employer and as well higher quality of life.
5. Length of hospital stay is in immediate correlation with costs of medical treatment.
6. In order to reduce treatment cost for the patients with maxillofacial fractures we should follow emergency treatment protocol immediately after sustaining an injury, discharging patients as soon as their health condition allows us to transfer them to hospitals with basic medical care or to send them to home care, whereby we do not expect any postoperative complications.

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CIJENA LIJEČENJA PACIJENATA S PRIJELOMIMA KOSTIJU LICA – BOLESNICI KLINIČKE BOLNICE MOSTAR 2002.–2006.

S A Ž E T A K

Ovim se istraživanjem željela odrediti ukupna cijena liječenja pacijenata s prijelomima kostiju lica, spoznati ustrojstvo troškova cijene liječenja, opisati čimbenici koji utječu na cijenu liječenja i otkriti načini ostvarivanja ušteda. Istraživani su bolesnici s prijelomima kostiju lica stradali u razdoblju između 1. siječnja 2002. i 31. prosinca 2006. godine koji su se liječili na Odjelu za maksilofacijalnu kirurgiju KB Mostar. Baza za istraživanje sadržavala je podatke iz povijesti bolesti, bolničkih registara i pojedinačne cijene liječenja dobivene u bolničkoj naplatnoj službi. Među 113 pacijenata s prijelomima kostiju lica 83% su bili muškarci prosječne dobi od $34,00 \pm 19$ godine. Najčešća vrsta prijeloma bio je prijelom jagodične kosti. Otvorena metoda koristila se u 85% pacijenata. Cijena liječenja otvorenom metodom bila je dvostruko veća od cijene liječenja konzervativno liječenih pacijenata. Razmjerno najveći udio u ukupnoj cijeni liječenja imali su troškovi lijekova koji su iznosili 38% i troškovi bolničkoga smještaja koji su iznosili 27% ukupne cijene. Smanjenje cijena liječenja pacijenata s prijelomima kostiju lica treba ostvariti zbrinjavanjem pacijenata po hitnom protokolu, dakle odmah nakon ozljeđivanja i njegovim otpuštanjem u bolnice nižeg ranga ili na kućnu njegu kada se više ne očekuju postoperativne komplikacije.