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GACETA MÉDICA DE MÉXICO **ORIGINAL ARTICLE**

Direct cost of primary care of mild traumatic brain injury in adults by GRD in third level of care

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Abstract

Objective: *To describe the direct cost of primary health care for patients with mild traumatic head injury in a third level medical facility.* **Design:** *Cross-sectional study in 219 patients with mild traumatic brain injury (GRD 090 S06.0 ICD-10 including uncomplicated concussion without complication and increased comorbidity).* **Location:** *A medical unit of tertiary care in the State of Puebla, Mexico.* **Main measurements:** *Direct costs were taken from ACDO.AS3.HCT.280115 / 7.P.DF Agreement and its annexes in Mexican pesos, the variables analyzed were age, gender, shift attention, laboratory, radiographic and tomographic studies, length of stay, specialist consultations, emergency care, medicines, and treatment materials. Descriptive statistics on SPSS program IBM v22.* **Results:** *53.4% male, 46.6% female; average age 31.9 years; morning shift attention 58.4%, evening 23.3%, and nightly 18.3%. The cost: $ 1,755 laboratory, plain radiographs $ 202,794, tomographic studies $ 26,720, consultation with neurosurgeon $ 279,174, emergency care $ 501,510; curing material: single steri drape $8,326.38, Micropore $1,307.43, infusion equipment $790.59, venipuncture needle $7,408.77; drugs: diclofenac $946.08, Ketorolac $724.89, 1000 ml. intravenous solution $1,561.47, total cost $ 1,032,293.72, average/patient: 4,713.66 Mexican pesos.* **Conclusion**: *The direct cost of primary health care of patients with mild traumatic head injury is high; sticking to the correct handling decreases the cost of attention.* (Gac Med Mex. 2016;152:675-9)

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Introduction

Mild traumatic brain injury (TBI) is defined by previous disorientation, amnesia or transient loss of consciousness in a TBI patient who is conscious and speaking, with a Glasgow score of 13 to 15 points[1]; it accounts for 75 to 80% of all TBIs[1-3]. The Advanced Trauma Life Support (ATLS) program has been adopted around the world to teach a standardized approach method for trauma patients[1]. Concussion without complication and comorbidity, and without complication or major comorbidity, is classified in ICD-10 section S 06.0, and is synonymous with mild TBI[4].

In developed countries, trauma is a significant cause of morbidity and mortality. Each year, 7.3% of total deaths (0.8 million) are due to trauma; it is the fifth most common cause of death after ischemic heart disease, cancer, heart failure and respiratory diseases[5,6]. In Mexico, the National Institute of Statistics, Geography and Informatics reported in the year 2005 that accidents represented the third cause of overall death; approximately 24,000 people die every year, Mexico is at seventh place in the world for deaths by traffic accidents, with 55 persons dying every day[7].

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In the USA, approximately 1,700 trauma brain injuries are reported per year, including 275,000 hospitalizations and 52,000 deaths; a figure that is on the rise[1,2].

In the Region of the Americas, traffic accidents are the cause of 142,252 annual deaths, in addition to an estimated number of more than 5 million injured[8].

Decision making in health requires validated instruments to improve management and verify the accomplishment of results at established schedules, with adequate use of resources. Diagnosis-related groups (DRGs) are a tool that enables for budget optimal level to be determined based, first, on the tendency of demand and, second, on the characteristics of the epidemiological profile of the causes for care, this way surmounting historical budgeting. DRGs are a system of patients' clinical and surgical diagnoses classification and grouping[9], which are constructed based on discharge diagnoses and on the combination of ICD-10 and ICD-9-CM different clinical characteristics (discharge and hospitalization, respectively), and constitute the IMSS case mix, with 9,680 diagnoses and 700 related groups[4,9,10].

The Mexican Institute of Social Security (IMSS – *Instituto Mexicano del Seguro Social*) is the most important health institution in Mexico and Latin America. It covers the national territory with 1,375 medical care units (at all levels), and offers coverage to 53,533,650 affiliates, which represent almost 50% of the Mexican population[9,11]. The purpose of this work is to determine the cost of primary care for patients included in the 090 S06.0 DRG (concussion without complication-comorbidity and without complication-major comorbidity) at the IMSS High Specialty Medical Unit (UMAE – *Unidad Médica de Alta Especialidad*) Trauma and Orthopedics Hospital of Puebla.

Material and methods

The study design was cross-sectional; the study period encompassed from January to March 2013, and took place in a tertiary care medical unit of the State of Puebla, Mexico. We included 219 patients diagnosed with mild TBI according to the ATLS diagnostic criteria. Included variables were age, gender, shift of provided care, laboratory tests, radiographic studies, CT scans, hospitalization length of stay, number of consultations by specialists, medications and wound-dressing materials. The IMSS DRG classification for concussion without complication and/or comorbidity and without complications and/or major comorbidity includes only one class: DRG 090 concussion without complication and/or comorbidity, and/or major comorbidity, main diagnosis S06.0, concussion. Direct costs of care were taken from the Agreement ACDO. AS3.HCT.280113/7.P.DF and its appendices, published in the Official Gazette of the Federation on April 18, 2013, and we considered the following prices: care in the emergency department, plain radiographic study unit price, price of consultation with specialist, prices of laboratory and CT studies, medications and wound dressing materials in Mexican pesos, updated to the year 2013 (Table 1).

Statistical analysis was descriptive. We used the mean as central tendency measure and the standard deviation (SD) as dispersion measure. The work was authorized by number 2015 Research and Ethics in Research Local Committee of the UMAE Trauma and Orthopedics Hospital of Puebla. The patients signed an informed consent form, and their anonymity was preserved at every moment.

Results

During the entire year of 2013 there were 4,015 TBIs, with 1,003 of them corresponding to mild TBI or concussion (ICD-10 S 06.0 classification), with a monthly average of 83 patients. Mild TBIs attended to at the emergency department during 2013 first trimester, which accounted for a total of 219 patients, were included.

Patients' age average was 38.47 (minimum 18 and maximum 89) ± 19.39 years; emergency department average length of stay was 3.51 (minimum 1 and maximum 24) ± 2.36 hours; 128 patients (58.4%) were attended to at the morning shift, 51 (23.3%) at the afternoon shift and 40 (18.3%) at the night shift; and 217 patients (99.1%) were discharged from the emergency department without complications. Socio-demographic data are shown in table 2.

Two patients (0.9%) were hospitalized for reasons other than mild TBI: 1 patient (0.5%) was hospitalized 1 day and 1 patient (0.5%) 2 days. Of both these patients, one had an upper limb fracture that required surgical management. The admission of both these patients for causes other than mild TBI generated a cost of $ 17,052.00.

Medical care expenses in all 219 patients were: laboratory tests $ 1,755.00, skull plain radiographs $ 202,794.00, simple CT scans $ 26,720.00, neurosurgeon consultation $ 279,174.00, emergency department care $ 501,510.00, wound dressing materials $ 17,833.17 and medications $ 3,232.44, which added up to a total cost of $ 1,033,018.61, with an average of $ 4,716.97 per patient with mild TBI. The comparison

Table 1. IMSS unit costs for 2013

Tertiary care	Charge
Specialty consultation	$ 966.00
Emergency care	$ 2,290.00
Patient-day (hospitalization)	$ 5,684.00
Clinical laboratory tests	$ 135.00
Radiodiagnostic study	$ 463.00
CAT scans	$ 1,336.00
Wound-dressing materials	
Surgical field individual pack	$ 38.02
Micropore tape	$ 5.97
Normodropper IV infusion kit	$ 3.61
Blood vessel puncture needle	$ 33.83
Medications	
Diclofenac 100 mg, 10-tablet pack	$ 4.32
Kerotolac 30 mg, solution for injection	$ 3.31

Source: Official Gazette of the Federation April 18, 2013, publication of unit costs for the determination of tax credits derived from amounts to be paid, inadmissible registrations and medical attention to non-affiliates.

between total costs and the cost that would have been generated if the ATLS recommendations for the management of these patients would have been followed is shown in figure 1.

Discussion

DRGs are widely used in some countries to compare hospital performance, to define payment categories and to facilitate hospital payment system based on groups[9,12]. Therefore, it is considered highly important for DRG systems to consider the most appropriate classification variables and to define as many groups as necessary in order for hospital payments to be fair[13]. This is why we decided to carry out this study where we included patients of the 090 S06.0 GRD cerebral concussion without complication and comorbidity and without complication or major comorbidity[4,10] to analyze primary care direct costs.

During the year 2013, mild TBI accounted for 75% of total traumatic brain injuries in this hospital, which is consistent with figures reported in the literature, where mild TBI is claimed to include between 75 and 80% of all TBIs, a figure that may be higher because a proportion of patients who suffer car accidents do not seek medical assessment[2,14,15].

In many hospitals, the emergency department is comprised by general surgery specialists, traumatologists, medical-surgical emergency medicine specialists and internists[5]. In addition, the fear of the risk that the patient develops any complication or evolves with neurological state deterioration drives these specialists to ask for assessment by the neurosurgeon, who, in turn, orders CT scans, skull plain X-rays or laboratory tests that increase the cost of primary care in these patients[5,15].

Average patient length of stay at the emergency department was 5.51 (minimum 1 and maximum 24) ± 2.36 hours. Considering that Glasgow Scale deterioration and degradation can be between 3 and 5.5% of patients with mild TBI attending for medical assessment[1,5,11], we consider that, in case of any doubt, minimum observation time should be extended in these patients to reduce the probability of neurological damage or complications secondary to mild TBI[1,15]. Some private medical care institutions in the USA report an average of 3 days' hospitalization for patients with mild TBI[11], which is also in disagreement with the literature, since hospital admission of these patients should occur only in special cases[1,5].

In this study in 219 patients with mild TBI, mortality was 0%, which is similar to that reported in the USA, where it is 0.2%[16-18].

Thirteen patients (5.9%) had preoperative studies practiced at the emergency department; however, only one (0.5%) was surgically intervened for a cause other than mild TBI, which implied an unnecessary expense of $ 1,755.00, as well as the risk an unnecessary IV infusion can produce. This is also in disagreement with the ATLS

Table 2. Socio-demographic characteristics of the patients with mild TBI included in the study

(n = 219)	n (%)
Gender	
Males	117 (53.4)
Females	102 (46.6)
Emergency department length of stay (hours)	3.51 (1 min. and 24 max.) ± 2.36
Hospital emergency department care shift	
Morning	128 (58.4)
Afternoon	51 (23.3)
Night	40 (18.3)
Number of laboratory tests per patient	
None	206 (94.1)
One	13 (5.9)
Two or more	0 (0)
Number of plain skull radiographic studies	438 (100)
Number of radiographic studies per patient in other sites	
None	0 (0)
One	0 (0)
Two	140 (63.9)
Three	19 (8.7)
Four	41 (18.7)
Five	7 (3.2)
Six	8 (3.7)
Seven	1 (0.5)
Eight	1 (0.5)
Nine	2 (0.9)
Number of contrast-free CT scans per patient	
None	199 (90.9%)
One	20 (9.1%)
Number of specialist (neurosurgeon) consultations granted to patients	
None	0 (0%)
One	160 (73.1%)
Two	49 (22.4%)
Three	9 (4.1%)
Four	1 (0.5%)

N: population; n: sample. Source: taken from patient medical files.

and the Italian Society of Neurosurgery recommendations for the management of patients with mild TBI, which indicate that general laboratory tests should be practiced in these patients only to rule out systemic injuries[1,5].

Each patient was taken two plain skull radiographs, which generated a cost of $ 202,794.00. Assessments by a neurosurgeon had a cost of $ 279,174, and the requested simple CT scans amounted $ 26,720.00.

The request for these studies and assessment by a neurosurgeon is also in disagreement with the ATLS recommendations for the management of patients with mild TBI. The recommendations for the management of patients with mild TBI are precise and stress that practicing a full neurological examination allows for an adequate follow-up of these patients to be carried out and this way omitting laboratory and imaging tests that may prove being unnecessary[1].

In addition, all patients were infused 1000 ml of mixed solution, which generated a cost of $ 1,561.47.

At the IMSS UMAE Trauma and Orthopedics Hospital of Puebla, total cost for the care of 219 patients with mild TBI in the year 2013 was $ 1,033,018.61 ($ 4,716.97 per patient), which is below the IMSS unit cost for DRG 090, which is $ 21,636.00 per patient. This price should be added care indirect costs, which were not considered since they are beyond the scope of the study.

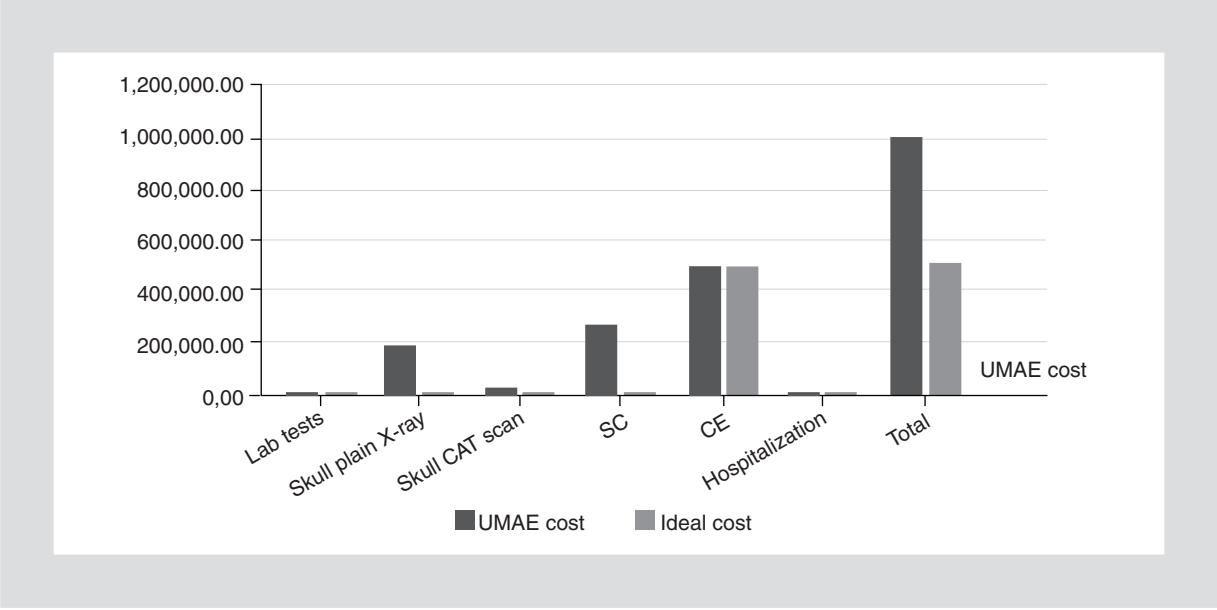

Figure 1. *Direct costs at the UMAE Trauma and Orthopedics Hospital of Puebla and ideal cost for the care of 219 patients with mild TBI. X-ray: radiograph; CAT: computed axial tomography; SC: specialist consultation; CE: care at emergency department.*

According to these results, if unnecessary expenses are excluded in these patients' primary care, the expense per patient is reduced by 89.45% below the IMSS unit cost for the management of DRG 090 S06.0.

From the above results, it is concluded that the direct cost of primary care for patients with mild TBI at the UMAE Trauma and Orthopedics Hospital of Puebla is high, and that adherence to protocols for the care of these patients significantly decreases direct cost of care; therefore, diffusion of and training on the ATLS-issued recommendations to all medical personnel involved with the care of these patients is suggested.

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