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Work-Related Finger Fracture Costs: a Quality Assessment of the Instituto Mexicano del Seguro Social Medical Care Services*

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RESUMEN

Objetivo: Comparar la oportunidad en el tratamiento y concordancia del diagnóstico entre 54 trabajadores que sufrieron fractura de dedos de la mano por accidente de trabajo con secuelas indemnizables (casos), y 45 trabajadores con fractura de dedos de la mano sin secuelas (controles); así como los costos de la atención médica y el pago de incapacidad permanente.

Material y métodos: fueron considerados los registros estadísticos del Instituto Mexicano del Seguro Social (IMSS) de los estados de Baja California Sur, Sonora y Sinaloa, sobre lesiones por accidente de trabajo durante 1995. La recolección de datos se llevó a cabo a partir de la descripción en los expedientes clínicos de la nota inicial de atención médica, el registro de calificación de probable riesgo de trabajo y el establecimiento de incapacidad permanente.

Resultados: se otorgó atención médica oportuna a 76 % de los casos y a 72 % de los controles. La mediana de días de aquellos que recibieron atención inoportuna fue de 2 (rango 1-69) en los casos y 1 (1-19) en los controles. El porcentaje y el coeficiente de concordancia de la primera atención médica, así como la otorgada por los médicos traumatólogos fueron bajo y medio, respectivamente, de acuerdo al criterio de Landis y Koch. Los costos totales de atención a la salud en pesos mexicanos fue de \$877 482 para los casos y de \$190 751 para los controles.

Conclusiones: la falta de oportunidad en la atención médica puede no estar asociada a la aparición de secuelas, pero la baja proporción de congruencia clínica-diagnóstica-terapéutica pone al descubierto la influencia de este factor en la calidad de la atención de las fracturas de dedos de la mano por accidente de trabajo. Por otro lado, los costos de atención de fracturas sin secuelas indemnizables fueron en definitiva más bajos.

SUMMARY

Objective: Our objective was to compare opportunity of treatment and agreement in diagnosis in 54 workers who experienced work-related finger fracture (FF) with indemnified sequel (cases) with 45 without sequel (controls), and to compare costs of medical care and disability payment.

Material and methods: Data sources/study settings were *Instituto Mexicano del Seguro Social* (IMSS) statistical records related to work accident-related injuries during 1995 in the states of Baja California Sur, Sonora, and Sinaloa in northwestern Mexico. Data collection/extraction methods, information from clinical files by means of description in initial medical record, record for qualifying probable work risk, and a statement of permanent work disability were used.

Results: Main findings included that opportune medical care was provided in 76 % of cases and in 72 % of controls. Median days for patients receiving delayed care was 2 (range 1-69 days) for cases and 1 (range 1-19 days) for controls. Percentage and concordance coefficients for first-time medical care as well as for care provided by traumatologists were low and medium, respectively, according to Landis-Koch criteria. Total cost health care in Mexican pesos (M. N.) for cases was \$877 482 M.N. and \$190 751 M. N. for controls.

Conclusions: Lack of opportunity for medical care could not be associated with appearance of sequelae, but low proportion of clinical diagnostic-therapeutic congruence revealed the influence of this factor in FF care quality. Moreover, health care costs in FF with no indemnified sequelae were definitely lower.

Palabras clave

- ✓ fracturas de dedos de la mano
- ✓ evaluación de la calidad de la atención a la salud
- ✓ accidentes de trabajo

Key words

- ✓ work-related finger fractures
- ✓ quality assurance, health care
- ✓ accidents, occupational

Introduction

Fractures that appear in fingers as the result of a work-related accident are probably the damage that demands the greatest amount of care, because it belongs to the functional part of the body that distinguishes the human race. If partial or total loss resulted during clamping or clamping functions in one or both hands, this would likely be accompanied by permanent functional disabilities. When these effects occur, they are magnified socially due to the fact that these individuals represent not only their family's main income source, but that these persons are also part of the country's productive group; furthermore, these persons are individuals who have the right to demand urgent and high quality social security services.¹⁻³

The hand is extraordinarily complex from anatomic and functional points of view. Damage caused to a distant limb, such as an elbow or shoulder, may generate dysfunction in this terminal unit and therefore require emergency treatment.^{2,3} This complexity increases in cases of injured workers and is also due to wound mechanisms, in that at the moment of the accident it may not be easy to identify which structures were affected, which were not, and which were definitely destroyed.⁴ Care to the fingers of the hand is considered a medical emergency, demanding the participation of specialists from various areas to achieve total recovery of this functional limb. It is evident that sequelae can be generated to a greater extent from deficient care than from extent of the injury.^{4,5} This information supports the fact that injuries to fingers, regardless of gravity and extent, require timely participation of available health services to avoid delays in presentation and management of unnecessary sequelae because their appearance will obviously prevent prompt worker/victim reincorporation on the job.⁶⁻¹⁰ This is in addition to negative effects on work productivity and financial consequences for social security institutions, which face the need to pay a greater number of absentee days, service over-demand, and with this to decrease or not to use medical equipment.⁶⁻¹⁰ This would also lead to precipitation of overtreatment provision and finally waste of coverage funds for paying indem-

nization due to sequelae present in workers or fractures in fingers that could have been avoided.

This, then, is the basis for our study, whose aim was to compare opportune treatment and congruence of diagnosis for two groups of workers who experienced work-related finger fractures: one group with sequelae leading to disability payments (cases), and a group with similar injuries but without sequelae and long-term disability (controls). Additionally, the study aimed to compare costs of medical care and disability payments of cases and controls, and between individuals receiving—and those not receiving—opportune and congruent medical care.

Materials and Methods

A cross-sectional study included 54 cases and 45 controls sampled according to age, occupation, and time of service. Cases were workers diagnosed with finger fracture (FF) and sequelae that can be indemnified. Controls were subjects diagnosed with FF with no sequelae at time of medical care. Statistic registration at the Mexican Institute of Social Security (IMSS) was applied to identify injuries as a consequence of a job accident reported in 1995 in workers insured by the IMSS in the northwestern Mexican states of Baja California Sur, Sonora, and Sinaloa.

Information was obtained from analysis of clinical files, through description of initial medical records (MT 4-30-8 format), family physician—signed notes in the clinical file, or the note to assess probable work risk (MT-1 format), in the statement of permanent work disability (MT-3 format) and in the overall record of occurred and concluded working risk (MT-5 format). There were 11 clinical records that described previous sequelae in the limb of individuals affected by the actual work-related accident or injuries to another limb; these subjects were excluded. In both groups, we also explored gender, age, and occupation.

To obtain quality factors of medical care, opportunity was compared to clinical, diagnostic, and therapeutic congruence according to the clinical guidelines of each FF type.¹¹⁻¹⁴ On the basis of these guidelines, timely care was registered from date of work accident, initial medi-

cal care provided by emergency-room services or family medicine consultants, and period of time between first medical care and specialized medical attention except for physical and rehabilitation medicine and/or occupational health services. When needed, lapses between specialized consultation and first surgery and between the latter and a second surgery were registered. The period between specialized medical care and intervention of physical medicine and rehabilitation services and lapse between date of work accident and medical discharge were also recorded.

On the basis of FF clinical guidelines, congruence between diagnosis offered during initial medical care with diagnosis offered by the physician specialist was compared. FF medical treatment congruence during primary care, when it complies with basic features in closed and exposed FF, was considered acceptable. To determine interobserver consistency between diagnoses offered by initial medical care and attention provided by specialized physicians from traumatology services as well as with treatment proposed by both, concordance percentage (%C) and concordance coefficient (CC) were calculated by kappa under Landis and Koch criteria.¹⁵

Significant costs including medical expenditures were calculated for cost analysis of medical care for FF; these included costs such as those for temporary work absence, severance payment costs in the group with sequelae that can be indemnified, and costs of monthly indemnization according to expected survival. Variables and semivariables costs were considered to obtain medical costs including medications, healing materials, vaccinations, and laboratory analysis, as well as hospitalization days, emergency consultations, family medicine appointments, specialized visits, physical medicine sessions, surgery, surgery room hours, physician hours, and nurse hours. Quantification of each variable under medical costs was calculated on the basis of unit cost lists issued by the General Controller of the IMSS Finance and Systems Office; a table of units for recovery of medical service expenses was issued by the same office. Total case cost was obtained by adding all above mentioned costs.

Results

Research included workers from three north-western Mexican states: Sinaloa, Sonora, and Baja California Sur. Analyzing general variables, mean age of workers included in the study was 34.2 ± 8.1 years; with regard to gender, there was a predominance of male workers because only 11 % of case group were women, whereas in control group all were males.

Concerning specific variable analysis, median (md) of sick leave days that any group required from their physician was 60 days. By analysis per group, md was 89.5 days (range: 29-385 days) for cases, whereas in control group this was 35 days (range 8-45 days). Regarding service duration on the actual job, global average was 3.9 ± 0.57 years in the same workplace, although mean was 2.8 years for case group and 5.1 for control group ($p = 0.038$). In proposed quality variables, primary timely medical care given to cases (76 %) and controls (72 %) did not show significant statistical differences ($p = 0.76$) nor for OR for FF sequelae due to delayed medical care, 0.70 (confidence interval 95 % [CI95 %]: 0.25-1.93). For those who received delayed medical care, md in cases was 2 days (range 1-69 days) and in controls, 1 day (range 1-19 days). Fourteen controls (30 %) and six cases (12 %) were not referred to the Traumatology Service; at this point of medical care, FF sequelae odds ratio (OR) due to delay was 0.30 (CI95 %: 0.21-0.85). Nevertheless, cases md was 20 days (range 3-90 days) and 6 days (range 1-49 days) for controls.

Concerning FF surgery solutions, 23 % of all patients required surgery and only 6% of patients in this group needed a second operation. The first of these operations took place at a greater proportion in workers who finally presented FF-indeminizable sequelae (38 %) than in those without sequelae (6 %, $p = 0.0004$). Cases of first surgery md was 8 days (range 0-105 days) and 0 days (0-48) for controls. Similarly the six recorded reinterventions were performed on the case group ($p = 0.02$) with md of 90 days between first surgical interventions and subsequent surgery (range 13-301 days); no more than two operations were registered for

any given patient. A total of 44 % of workers with FF were evaluated by Physical Medicine & Rehabilitation Services; 75 % of cases and only 9% of controls ($p = 0.00001$) were seen at these services, although md for these evaluations (from the moment of first specialized medical care in the group finally presenting sequelae was 52 days) (range 1-288 days), whereas in patients with no sequelae md found was 63.5 days (range 7-80 days). Only four patients (9 %) from control group finished the rehabilitation program and were discharged from the Physical Medicine & Rehabilitation Service.

Occupational health services participated in accident certification and medical statements caused by FF as a consequence of work in all patients to establish absence of economic benefits and to determine could-be-indemnified sequelae. Md from moment of accident until services were requested was 2 days (range 0-72 days) in case group and 2.5 days (range 1-9 days) in control group. It must be noted that in some worker cases, transfer to these types of services

(for accident assessment) was delayed, mainly due to the employee's not requesting the necessary form (MT-1) that is filled out on a mandatory basis. Determined indemnification percentage md in this type of service in the 52 cases involved was 4% (range 2-26 %). Table I shows FF diagnosis variants obtained at time of medical attention for both groups; it is important to note that 33.3 % of all study records did not establish specific diagnosis or show any FF clinical presence; presence of this morbid condition was determined subsequently when the accident that caused FF was qualified by occupational health services as a work-related injury. Distribution of various types of diagnosed fractures did not present significant statistical differences between cases and controls ($p = 0.60$); on the other hand, in FF diagnosis integration only 32 % of all clinical records were rated congruent, based on clinical data and auxiliary procedures stipulated by the group of experts and observed in the guidelines as necessary to integrate FF diagnosis. Furthermore, this circumstance of diagnostic congruence showed im-

Table I
Mean costs according to timeliness and congruence in FF medical care*

	Group	Mean medical cost*	<i>p</i>	Disability cost*	<i>p</i>	Total cost*	<i>p</i>
Total cost	Cases	8 506.70	0.00009	7810.33	0.000004	16 249.66	0.000001
	Controls	2 656.00		1582.88		4 238.91	
Opportune	Cases	13 187.60	0.03	7286.13	0.008	20 463.65	0.001
	Controls	3 675.66		2096.66		5 772.33	
	Total	11 219.62		6212.44		17 432.00	
Inopportune	Cases	5 590.48	0.009	8347.12	0.0009	13 792.16	0.0002
	Controls	2 931.72		1814.68		4 746.44	
	Total	4 261.10		5080.90		9 269.30	
Congruity	Cases	8 154.62	0.007	8963.25	0.001	17 117.50	0.001
	Controls	3 063.55		1847.44		4 911.05	
	Total	4 630.03		4036.92		8 666.88	
Incongruity	Cases	9 643.76	0.001	7751.89	0.0003	17 302.46	0.000001
	Controls	2 834.76		1474.53		4 309.30	
	Total	7 941.51		6182.55		14 054.17	

*All costs are in Mexican pesos

portant differences between the two study groups, i. e., 15 % in cases and 40 % in controls ($p = 0.009$). In relation to lack of timely care, noncongruent diagnosis for FF shows OR: 3.8 (CI95% 1.34-11.22) for appearance of sequelae.

For analysis of interobserver consistency between first diagnosis of family medicine or medical emergency services and final diagnosis integrated by traumatology specialists, direct-method concordance percentage (%C) was applied and concordance coefficient (CC) indirect method was used by means of calculation of non-weighted kappa interpreted under Landis and Koch criteria regarding diagnosis of nominal character. Considering presence of nonspecific diagnosis for primary medical care as well as for care provided by traumatologists, %C and CC are quite low (45 %) and merely fair (0.29), respectively. On the other hand, if we include only clearly constituted diagnoses ($n = 41$), %C and CC reach a high mark (76 %) and complied in agreement that can be considered excellent (0.67);¹⁵ patients were excluded from these calculations, including patients registered as referred or consulted by traumatologists. FF management established by this group of specialists was impossible to identify in 21 % of records because specialists did not participate in medical care; in patients who did receive medical attention, only 15 % received treatment relevant to diagnosis established in case group and 38 % for control group ($p = 0.0015$) according to stipulations of the same group of experts who considered treatment at first medical care. Treatment established by the Traumatology Service, calculated by the same criteria as previously described, was fair (58 %) with minimum level of agreement (0.16).

In relation to cost analysis, total cost of cases ($n = 54$) resulted in \$877 482 Mexican pesos (M.N.) with mean per patient of \$16 250 pesos, whereas controls ($n = 45$) resulted in \$190 751 M.N., with a mean of \$4239 M.N. Medical cost analysis according to opportunity and therapeutic-clinical-diagnostic congruence is presented in Table I.

With regard to variable costs, laboratory tests and hospitalization days generated by cases (\$1943.27 M.N.) are those with an impact on this increase in comparison with controls (\$11.17 M.N.); as for semivariable costs, family medicine consultations and those provided by

medical specialist-surgeries, and number of physical medicine sessions taken together, elements that increased medical costs of patients included in the same group of cases (\$5450.37 M.N.) in comparison with the same costs in controls (\$1753.52 M.N.). Apparent lack of opportunity for medical care was determined by lesser use of analgesics/antibiotics, antitetanus protection, imaging examination applications, laboratory tests, and hospitalizations, as well as transfers to medically specialized services, and as a consequence to surgical interventions as indicated in the FF-type guidelines. In medical cost according to therapeutic-diagnostic-clinical congruence in patients with qualification of incongruence, hospitalization days, family medicine care, medical specialization, physical medicine sessions, and surgical operations were elements that increased cost of medical care. Variable and semivariable costs in congruent medical care were \$4601.39 M.N., while those in incongruent medical care were \$7844.66 M.N.

Concerning costs of temporary or permanent work disability in patients with opportune medical attention, cost was \$101 961 M.N., whereas in patients with no timely medical care payment cost was \$147 573 M.N. If we consider medical care congruence, patients qualified as incongruent exhibited higher mean temporary work disability cost (\$190 664 M.N.) than those qualified as congruent (\$52 589 M.N.).

Discussion and Conclusions

In some studies concerning finger-affecting injuries, which amounted to 25 % of injuries produced by effects of work, although these are not considered the most frequent, we found that from the occupational point of view these injuries are those that produce more disabled persons.^{16,17} Therefore, once patients are identified as having FF, one expects great mobilization of multiple services and specialized physicians to avoid or diminish appearance of associated sequelae, as it is well known that these could disable accuracy, pressure, or clamping movement, which distinguishes this irreplaceable part of the thoracic limb from the remainder of the human body's musculoskeletal structures.^{1,2} A similar situation

involves preventive actions executed to maintain integrity of fingers in the work-force individual, because accidents that cause FF are a problem relevant to occupational health in which it is easy to imagine the effects these accidents would have on an individual's working life and residual skills, in enterprise productivity, and in medical care costs for accelerating job reincorporation. In our study, FF were present in relatively young workers, with predominance in males who referred limited experience at work and who generally did not require specialized technical training, e.g., mechanics, bricklayers, and general laborers; but in some way, these workplaces and occupational experiences referred clearly to involve great exposure for FF with sequelae. Furthermore, at the moment of the accident non-safety attitudes prevailed in workers themselves. This is contrary to reports from other researchers, where 80 % of work-accident cases with finger-injury consequence show lack of compliance with safety measures attributed to the worker at the time of the accident.¹⁸⁻²⁰ It is worth mentioning that the group of cases reported a great number of exposed fractures, which are the most severe; nevertheless, there were proportionally no differences in control-group FF. This highlights the fact that appearance of sequelae is more relevant to medical care quality than fracture severity. On the other hand, FF presence represents partial or total loss of manual abilities for life in this group of workers and probable loss of expectations for reaching professionalism at other workplaces.²¹

In terms of medical care quality variables provided to these patients, non-opportunity for primary medical care (as well as for care provided by a specialized physician) according to clinical guidelines could not be associated to presence of sequelae;²⁻⁵ on the contrary, number of days prior to medical care was substantially different. The probable reason is that intervention of the specialized physician was delayed within the context of the problem studied due to the fact that sequelae were already present, and there was nothing—or not much—to offer with regard to traumatologic or rehabilitating treatment. In the course of medical care of these patients, we must highlight the need to provide this care and to perform case evaluation from the specialized physician's point of view,

in that an important number of patients presenting (or not presenting) sequelae were not transferred to specialized services. This fact alone increased possibilities of sequelae; therefore, this step should not be omitted under any circumstances.^{16,17,20}

Regarding diagnosis, proportion of patients with *n* diagnosis provided during primary medical care (not by a specialized physician) can be interpreted as alarming because this relevant absence demonstrates negligence, contributing to appearance of sequelae and diminishing quality of FF medical care. Furthermore, in cases in which this basic statute complied, low proportion of clinical-diagnostic-therapeutic congruence uncovered participation of these factors in global care quality in this type of patient linked with greater number of sequelae; thus, it was expected that concordance levels would be fair or minimum and accompanied by inconsistencies in subsequent FF management. This placed the studied sample of medical care quality in a more dubious position, in which fortunately some members did not exhibit additional damage due to deficiencies in this previously mentioned care. This motivates training scope, strengthening diagnosis criteria unification and practical application (or even submission) for evaluation purposes of clinical guidelines to treat this type of injury in patients.

According to other communications, cost analysis resulting from management of these patients was part of total spiraling cost of medicine currently required to provide overall care for main health problems.²¹ In this context, the aforementioned observations acquire a more extensive conclusion, as we observed that total cost of group cases was four times greater than that of control group, in which incongruous clinical-diagnostic-therapeutic management took place in the greater cost-based impact quality variable in addition to being direct cause of the appearance of a greater number of severance payment costs and increase in average of work absence days due to temporary disability. This shows the economic effects generated by deficiencies in care quality; on the other hand, timeliness appeared as a variable that increased mean costs, but when separating variable and semi-variable medical costs we observed that resource application indicated by experts who established

FF clinical guidelines was applied in medical management.

Contrary to our thinking, medical care total cost is not primarily affected by payment for identifiable sequelae, but by temporary work disability costs. This information can be translated into an effective contribution not only for inclusion of medical attention costs but for costs applied to indemnified sequelae accompanied by payment for work-disability absent days granted beyond that required by normal FF management. According to other reports concerning the fact that this cost proportionally dominates all others, there is no way to accept in this field that possible justification of probable increase of these costs could be due to more severe injuries (not work-attributed) than FF, thus weakly supporting provision of further unnecessary temporary work-absent days. Currently, the hypothesis that these injuries are as expensive as their severity lacks real argument; additionally, FF surgical operations carried out with conventional means are as successful as when using more sophisticated means, and although these allow early work reincorporation this is so only if patients have support from rehabilitation services. In any case, costs in worker FF care accompanied (or not accompanied) by identifiable sequelae were extraordinarily high, as in other studies.²⁰⁻²⁶

Medical care cost rise is a progressive difficulty for any health system and can reach the characteristics of a real national financial crisis. This must not be focused only on restricting development (and spreading) of useful clinical technology, but must also highlight the important need of the entire medical staff to consciously act on the FF worker's care provision, as in circumstances under which treatment proposed by the physician who assisted the FF for the first time and treatment proposed by fair intervention of the specialized physician group were jointly under agreement with treatment criteria described by the group of experts who established clinical guidelines. The score reached in quality variables was good or excellent, considered examples of recommendation of application in medical practice, as well as being gold standards for future research and effective samples for secondary or tertiary prevention of this type of injury. If we adhere to clinical guidelines in FF treatment in addition to improving service organization,

we will contribute to elimination of overwork, which will effectively decrease the number of cases with accompanying sequelae, while also reducing medical care costs provided by any health system.²⁷⁻²⁹

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