ORIGINAL RESEARCH

Primary care management for isolated limb injury: Referral to orthopedic surgery in a trauma center

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Abstract

Introduction: Musculoskeletal injuries affect up to 13% of adults annually. Despite this high incidence, quality of primary care, including analgesia, may be sub-optimal. The goal of this study is to describe the quality of primary care for ambulatory patients with isolated limb injury and to identify related factors.

Methods: A cross sectional study was undertaken prospectively on 166 consecutive ambulatory adult patients with isolated limb injury who presented to orthopedics service in a Level one Trauma Centre. Quality of care was assessed by evaluating analgesia, walking aids, immobilization, and quality of referral diagnosis according to actual expert recommendations.

Results: This study revealed low quality of primary care for 82 (53.2%) of injured patients. Seventy-three patients (50.3%) had pain level over 5/10 and 45 cases (28.5%) had insufficient/absent analgesia prescriptions. Fifty-one (32.3%) had unacceptable immobilization and 21/59 (35.6%) patients with a lower limb injury did not receive a walking aid prescription. A total of 61 patients (36.7%) had an absent or inadequate referral diagnosis. Factors associated with lower quality depended on the specific quality indicator and included: living further away from the hospital, younger age, initially consulting at another health care center, having a fracture, and being a smoker.

Conclusion: The high frequency of low quality of care underlines the necessity for orthopedic surgeons to be involved in primary care education. Identifying factors associated with lower quality of care will orient efforts to im-

prove medical care of patients with isolated traumatic injury.

Serious isolated limb injury requiring medical care affects 9% to 13% of adults annually.¹ With an incidence of fracture of 8.5 per 1000 adults and an incidence of dislocation of 1 per 1000 adults,² limb injuries represent a large proportion of the work load for primary care physicians and orthopedic surgeons. To access to the orthopedic surgeon, a patient usually first consults a primary care physician who have the responsibility of initial limb injury management quality. Quality of initial care for a limb injury may be characterized by appropriate use of analgesia, immobilization and walking aids, proper diagnosis and patient satisfaction.^{3,4,5,6,7} Despite the high prevalence of limb trauma, initial management is poor according to the international literature. Only 50% of patients with long bone fractures received analgesia in emergency.^{6,8,9} According to the pediatric literature, 32% of children with time sensitive pathologies referred to a tertiary care hospital had mistakes in initial management and diagnosis or unacceptable delay of referral⁷. In the context of fracture/dislocation of the

ankle, 8.7% of patients were not immobilized after reduction, leading to re-displacement.¹⁰

The primary objectives of this study were to describe quality of care received for an isolated limb injury before referral to orthopedic surgeons in a Level 1 Trauma Center and to identify factors affecting quality of care. We hypothesized that many patients would receive sub-optimal care initially for limb injury prior to orthopedic consultation and that socio-demographic factors would be related to lower quality of care.

Materials and Methods

Study design and setting

This cross-sectional study was conducted at Sacré-Coeur Hospital in Montreal, Quebec, Canada, a 420 bed tertiary care level one trauma center. The orthopedic service is composed of nine orthopedic surgeons specialized in trauma. They provided a diagnosis that was confirmed by an orthopedic trauma fellow. There is no screening system for injury referral – thus access depends on prompt referral and perception of urgency by the primary care physician. Urgent referrals can be seen the same day by the team on call and non-urgent cases are typically referred to the next day trauma clinic. The Hospital and University Research Ethics Committee approved the study protocol and all participants signed an informed consent form.

Study patients

Inclusion criteria were all ambulatory adult patients, 18 years and over, with an isolated limb injury referred to the orthopedic service. Limb injury could be fracture, dislocation or soft tissue lesion. Exclusion criteria were: inability to speak French or English and having an injury that occurred more than three months earlier. Non-ambulatory patients arriving in ambulance and poly-traumatized patients were excluded.

Sources of referrals were MDs from: the same hospital, a different hospital, local community health centers and family medicine clinics. During the week

days patients were seen in a walk-in orthopedic emergency clinic. At night and on the week-end patients were seen in the hospital emergency by the orthopedic team on call.

Data collection and measures

Following the first orthopedic visit for an injury, patients meeting the inclusion criteria were recruited by a research nurse who administered a structured interview. Patients first answered a questionnaire that addressed socio-demographic data, injury history, past medical history, primary care initial treatment, time of injury and time of each medical consultation. Patients rated pre-injury health status from excellent to very bad. We asked participants about consumption of tobacco, alcohol and drugs.

A second questionnaire was completed by the treating orthopedic surgeon regarding the type of injury, quality of immobilization and walking aids, adequacy of referral diagnosis and type of treatment offered. The orthopedic surgeon's diagnosis was compared to the primary care physician's diagnosis. The latter was classified as: absent, correct, or incorrect, using the orthopedic surgeon's diagnosis as the "gold standard". The orthopedic surgeon classified immobilization as follows: adequate, inadequate, absent and unnecessary, or absent and necessary. Criteria for inadequate immobilization were: not immobilizing proximal and distal joints, absence of use of padding on the skin, use of inappropriate material, immobilizing the joint in the wrong position or presence of a constricting bandage.^{4,5} The AO classification "Arbeitsgemeinschaft für Osteosynthesefragen" was used for fractures.¹¹ Soft tissue injuries were described by anatomical structure and type of injury.

A third questionnaire was completed by the patient regarding pain relief treatment, immobilization comfort and walking aids, as well as an evaluation of pain using a scale of 0 to 10 for pain level.¹² The patient rated walking aids as: adequate, absent and unnecessary, or absent and necessary. Analgesia prescription

was classified in four categories: present and sufficient, present and not sufficient, absent and unnecessary, or absent and necessary. Sufficient analgesia must relieve pain to let the patient sleep at night and permit minimal daily personal activities. Insufficient was considered as pain level being $>5/10$. Also, we asked patients to rate their pain at the time of the orthopedic visit. We set an acceptable level of pain according to the American Pain Society recommendations for acute pain management who describe an acceptable level of pain to be at most 4/10.¹³

In terms of proximity to the hospital (geographic factor), we calculated distance between the patient's home and the hospital with the aid of the Mapquest program (www.mapquest.ca).

Analysis

Descriptive data were used to characterize the cohort in terms of age, sex, health status, type of lesion, time of injury, ethnic characteristics, and socio-economic status. All distributions of continuous variables were tested for normality. Proportions were used to report categorical variables. Quality of care was described in terms of analgesia, immobilization and walking aids and proper diagnosis. We sought to identify factors affecting quality of care. These factors included patient characteristics (sex, age, education, legal status, family income, working status, financial compensation for the injury, country of birth, proportion of their life in Canada, distance between home and hospital, health status, co-morbidities, prescribed medications, smoking status, alcohol and drug), injury characteristics (fracture or soft tissue injury, site of injury), and patient need (patient perception of injury severity, surgeon perception of severity: necessity of treatment, e.g. surgery or immobilization). We also explored the association between type of primary care resource and quality of care.

In order to determine factors associated with quality, we used bivariate analyses and also multiple logistic regression, classifying each outcome (analgesia,

immobilization, walking aids, and proper diagnosis) in two categories: acceptable and unacceptable. We used multiple linear regression models to explore factors associated with pain. Specific factors for these two outcomes were: quality of care indicators, patient characteristics, and injury type. We included variables that had a p value <0.20 in the bivariate analysis as candidate variables in the multivariable models. We assessed correlation between the various quality of care indicators using Spearman correlation coefficients. We also explored the correlation between delay of referral and quality of care.

Results

Demographic Data

A total of 201 ambulatory patients were referred to orthopedic surgery for an isolated limb injury during the 4-month study period from September 1 2006 to December 31 2006. Of 178 eligible patients, 166 accepted to complete all questionnaires for a response rate of 93.3%. Socio-demographic characteristics, co-morbidities and injury information are described in Tables 1 and 2. Sources of referral varied: 76 (45.5%) were referred from the same hospital, 67 (40.1%) from a family medicine clinic outside the hospital, 13 (7.8%) from another hospital and 6 (3.6%) from a community health center.

Results for each of the 5 outcome measures (analgesia and pain, immobilization, walking aids and proper referral diagnosis) are presented below. We also present factors that are associated with each of these quality indicators. A table with the top 5 diagnosis in terms of frequency is presented with their incidence of suboptimal care for immobilization, analgesia and diagnosis (Table 1).

Analgesia

Analgesia was characterized by level of pain at the time the patient saw the orthopedic surgeon and by classifying analgesia prescription (Table 2). Using a

scale from 0 to 10, average pain was 4.4/10 (Standard deviation (SD): 3.2) and 50.3% (73/145) of patients described a pain level over the 4/10 benchmark guideline of the American Pain Society.¹³ Analgesia prescription evaluation is reported in Table 3; 28.5% (45/158) of patients had an “unacceptable” prescription (insufficient or absent), preventing sleep with a pain level > 5/10. Patients with “acceptable” pain management reported, on average, a pain level of 3.9/10 compared to 6.0/10 for patients with “unacceptable” pain management ($p < 0.001$).

TABLE 1. Rate of suboptimal treatment for 3 criteria: analgesia, immobilization and diagnosis according to top 5 more common injuries

Injury site	Inadequate Immobilization	Inadequate analgesia	Inadequate diagnosis
Distal radius fracture	39% (12/31)	41% (13/32)	30% (10/33)
Metacarpal fracture	38% (6/16)	7% (1/15)	19% (3/16)
Phalanx fracture	10% (1/11)	18% (2/11)	50% (6/12)
Ankle fracture	41% (7/17)	24% (4/17)	32% (6/19)
Soft tissue injury	n/a	20% (5/25)	44% (11/25)

*Variability in denominators is secondary to missing data

TABLE 2. Descriptive data

Demographic data	Average	Standard deviation range
Age (years)	48	19 ; 18-88
Education (years)	14	4.5; 2-37
Distance home-hospital(km)	15.9	55.5; 0-616
	Number of patients	Proportion (%)
Sex female	85	51
Life habits		
Smokers	45	26.9
Alcohol drinker	73	43.7
Illicit drug consumption	13	7.8
Family annual income		
<30 000 \$	49	29.4
>30 000 \$	117	70.6
Residence		
Familial home	158	94.6
Institution(prison, seniors residence)	8	0.4
Working status		
Working	102	61.1
Retired	45	26.9
Other(volunteer, unemployed)	19	13
Mother tongue		
French or English	115	69.3
Other	51	30.7
Citizenship		
Canadian	119	71.3
Other	47	28.7
Health status (Patient Rated):		
Good or excellent	150	89.8
≤ 1 co morbidity	138	82.7
≤ 1 prescribed medication	130	77.9
Patient home city		
Same as the hospital	96	57.5

TABLE 3. Injury Information

Characteristics	Number	Proportion (%)
Injury type		
Fracture	142	85.5
Soft Tissue	24	14.5
Injury site		
Lower limb	59	36
Upper limb	107	64
Perception of Severity		
1 "not severe"	6	3.7
2 "partially severe"	74	45.7
3 "severe"	53	32.7
4 "very severe"	14	8.6
5 "extremely severe"	15	9.3
Most frequent fracture site		
Distal radius/ulna	33	19.8
Metacarpal/hand phalanx	28	18.5
Ankle	19	11.1
Metatarsal/foot phalanx	15	9
Most frequent soft tissue site		
Knee ligament	5	3
Wrist sprain	4	2.4
Elbow dislocation	4	2.4
Ankle sprain	3	1.8

Bivariate analyses were done to identify potential factors related to low quality of pain management as well as correlations with other markers of quality. Patients with self-perceived higher severity of injury had significantly more pain compared to patients with a perception of low severity (5.1/10 vs 2.8/10, $p=0.008$). "Unacceptable" analgesia prescription was associated with "unacceptable" walking aids prescription (odds ratio(OR)= 3.2 ; $p=0.012$) and increased distance between hospital and patient's home ("unacceptable" analgesia cases lived on average 34.1km from the hospital vs 9.6 km for "acceptable" cases $p=0.011$). Longer referral delay between the primary care visit and the orthopedic consultation was associated with "acceptable" pain management (76.0 hrs vs 43.8 hrs, $p=0.047$). Multiple logistic regression confirmed that "unacceptable" quality of walking aids was associated with "unacceptable" quality of analge-

sia (OR= 3.7, 95% CI 1.4-9.9; $p=0.008$), however, no patient characteristics or factors related to perception of need were associated with quality of analgesia.

In the multivariable linear regression model ($r^2=0.2$), higher pain level was associated with "unacceptable" analgesia ($B=2.2$; 95% CI 1.1-3.4) and patient perception of having a severe injury ($B=1.2$; 95% CI 0.5-2.6).

Adequate immobilization of fracture

We defined immobilization as inappropriate if: a) it was not immobilizing joints proximal and distal to the injury site, b) there was an absence of use of padding for the skin, c) inappropriate material was used, d) the joint was immobilized in the wrong position, or e) there was presence of a constricting bandage. The last criterion was assessed by the surgeon in terms of patient comfort or presence of signs of compression. Immobilization was judged necessary for cases of fracture or joint instability. The "inappropriate" category and "absent and necessary" category were classified as "unacceptable" immobilization (Table 4). "Absent and unnecessary" and "adequate" immobilization were classified as "acceptable". Quality of immobilization was "unacceptable" in 51 patients (32.3%) (Table 5). This quality criterion was not associated with higher pain level, however bivariate analyses revealed that smoking (OR: 3.3; $p=0.001$), first visiting another hospital (OR:3.9; $p=0.001$) and having a fracture instead of a soft tissue injury (OR:3.9; $p=0.024$) were related to poor or absent immobilization. In the logistic regression model all three factors remained significantly associated with "unacceptable" immobilization: smoking (OR 4.1; 95% CI 1.8-9.3; $p=0.001$), first visiting another hospital (OR 3.9; 95% CI 1.8-8.5; $p=0.001$) and having a fracture instead of soft tissue injury (OR 5.5; 95% CI 1.4-21.9; $p=0.001$)

Walking Aids

Walking aids was characterized as "inadequate" in absence of prescription for a patient who needed

TABLE 4. Descriptive results of quality of care indicators and dichotomic classification

Factors/categories	N (%)	N (%)	N (%)
		Acceptable	Unacceptable
Analgesia prescription†		113 (71.5%)	45 (28.5%)
Present and sufficient	64 (40.5%)		
Absent and non necessary	49 (31.0%)		
Present and insufficient	17 (10.8%)		
Absent and necessary	28 (17.7%)		
Immobilization†		107 (67.7%)	51 (32.3%)
Present and adequate	82 (51.9%)		
Absent and non necessary	25 (15.8%)		
Present and inadequate	17 (10.8%)		
Absent and necessary	34 (21.5%)		
Walking aids prescription‡		138 (86.8%)	21(13.2%)
Adequate	37 (23.3%)		
Absent and non necessary	101(63.5%)		
Absent and necessary	21(13.2%)		
Referral diagnosis		105 (63.3%)	61 (36.7%)
Correct	105 (63.3%)		
Incorrect	18 (10.8%)		
Absent	43 (25.9%)		

Unacceptable results for quality of care are underlined in the middle left column.

† These 2 categories had 8 missing data. (4.8%)

‡ This category had 7 missing data. (4.2%)

TABLE 5. Correlations (Spearman r) between quality of care indicators.

Indicators	Immobilization¥	Walking aids‡	Analgesia¥
Walking aids‡			
Coefficient	0.519		
Significance	0.001†		
Analgesia¥			
Coefficient	0.126	0.428	
Significance	0.119	0.002†	
Referral diagnosis¥			
Coefficient	0.126	0.124	0.094
Significance	0.114	0.119	0.243

† p< 0.05.

‡N=59 for patients with lower limb injury only

¥N=166 for all patients

crutches, cane, wheelchair or walker. Walking aids prescriptions were absent for 21 patients with a lower limb injury; 21/59 (35.6%) received no prescription for a walking aid and they needed it. These patients had a higher level of pain at the time of orthopedic consultation: 6.1/10 compared to 4.3/10 ($p=0.048$) among patients with adequate walking aid prescription.

Bivariate analysis revealed that age and smoking status were related to quality of walking aids. Patients with no prescription for walking aids with lower limb injury were younger than those who received appropriate prescriptions (mean age 40.1 vs 50.2, $p=0.03$). A positive smoking status was associated with no prescription of walking aids (OR: 3.0, $p=0.016$). Inadequate prescription of walking aids was associated with poor analgesia (OR 4.4 ; $p=0.03$) and unacceptable immobilization (OR 9.9; $p=0.002$).

In the logistic regression model, only “unacceptable” immobilization was found to be associated with “inadequate” prescription of walking aids (OR: 4.9, 95% CI 1.8-13.2; $p=0.002$).

Quality of referring diagnosis

Referring diagnosis was compared with the orthopedic surgeon's diagnosis. There were 61 patients (36.7%) who had an incorrect or absent referring diagnosis and smokers were less likely to have an “unacceptable” diagnosis by their primary care physician (OR 0.4; $p=0.018$).

Correlation between quality indicators

Distribution of patients who received low quality of care according to quality indicators is showed in figure 1. We used Spearman correlation coefficients to describe correlation between quality indicators (Table 5). There were moderate and significant correlations between “unacceptable” walking aids and both immobilization and “unacceptable” analgesia.

Discussion

This study revealed suboptimal quality of primary care for isolated limb injury in 53% of patients who present unacceptable care in at least one of the quality

FIGURE 1. Distribution of patients with inappropriate quality of care according to 3 indicators
From the total group of 166 patients, 82 (53.2%) patients had at least one of the three indicators revealing low quality of care. Of them, 28 (18.2%) patients had 2 or more indicators associated with suboptimal care. A total of 72 (46.8%) patients received adequate treatment according to these three categories. We had missing data on 12 (7.2%) patients.

of care indicators. More than half of the patients had unacceptable pain levels and more than a quarter had insufficient or absent prescriptions for pain treatment. But this could be multifactorial. A third had unacceptable immobilization, maybe because most walk-in clinics do not have plaster or splint available to them. Thirty-six percent (36%) of patients with a lower limb injury did not receive a walking aid prescription and 37% had an absent or inadequate referral diagnosis. Factors associated with lower quality depended on the specific quality indicator; these factors included living further away from the hospital, younger age, initially consulting at another health care center, having a fracture, and being a smoker. On the other hand, smokers were more likely to have appropriate referral diagnoses.

We compared our results with those in the literature. Speed et al. reported that 65% of their cohort had absent or inadequate referral diagnosis for orthopaedic surgery which was considerably higher than the 37% in our study.¹⁴ However, in their study, they include other pathologies that can be more complex than an isolated limb injury. Eight percent of patients with fracture dislocation of the ankle who presented to the emergency had absent immobilization and consequently experienced re-dislocation. The rate observed in this study of absent immobilization was 21.5%.¹⁰ We included all isolated limb injuries and most are less severe than ankle dislocation, which always requires immobilization. Among 372 pediatric orthopaedic emergency consultations, there were 6/26 cases of initial poor management of time-sensitive paediatric orthopaedic pathologies that were related to unacceptable immobilization.⁷ In our group, 51/82 patients receiving low quality of care had unacceptable immobilization. Our patients were not only referred from the emergency room and the age distribution was significantly different which may account for the higher proportion in our study with unacceptable immobilization. Finally, our results on pain management are no different than reported in the literature with only 50% of patient receiving a prescription for analgesia. The

reported frequency of pain medication prescribed for long bone fracture is between 50 and 70%.^{8,12}

Our data support that several factors are associated with quality of care. Younger patients, smokers, patients living further from the hospital, and consulting first another health care center received suboptimal care. Patients who were referred sooner reported getting less appropriate pain management. It is possible that the primary care physician will pay less attention to pain management, knowing that the patient will be seen sooner. Another explanation for higher pain when patient is seen sooner is that patients have more pain earlier after the injury secondary to initial acute inflammatory phase.

Patients living further from the hospital may have initially consulted smaller clinics that were closer to them and these places may have been less adept at dealing with orthopaedic type injuries. Previous studies, mainly done in private health care systems, report that factors affecting quality of care include ethnic characteristics, socioeconomic status, type of health care facilities and crowding of emergency department.^{15,16,17,18} No associations were found between quality and ethnic or socioeconomic characteristics and this may be, in part, due to the fact that in Canada, all persons have access to the same type of care regardless of socioeconomic status, ethnicity, or type of health care facility.

Interestingly, there was a convergent phenomenon around poor initial management of limb injury (Figure 1 and Table 5). Patients with inadequate walking aids prescription also tended to receive unacceptable immobilization and analgesia. The lower quality of immobilization may be explained by several factors. First, there may be a lack of knowledge regarding the importance of good immobilization to protect soft tissue and improve patient autonomy.^{10,19} Second, there is often little time to do a proper immobilization in the context of a busy emergency room.²⁰ But proper time should be taken to immobilize patients. Third, there may be a lack of materials for proper immobilization in the emergency room or walk in clinic.

Poor analgesia prescription is associated with many factors according to the literature. Physician and nurse evaluation of patient pain are known to be much lower than patient self-reported pain and this may have been the case in our cohort as well.^{6,8} Although we did not document physicians' attitudes and beliefs, others have shown that fear of creating narcotic addiction or related complications can deter a doctor from ordering stronger pain killers.^{9,12}

There are several limitations to our study. We relied on patient's descriptions of events and previous primary care visits. The information written on the orthopedic consultation requisitions were minimal in most cases and charts were not available for majority of patients. Only patients referred to orthopedics were included. We hoped to reduce recall bias by limiting the time from the injury to 3 months. At the same time, by excluding cases referred more than 3 months post injury, we may have introduced selection bias.

In conclusion, our study highlights the suboptimal quality of primary care for isolated limb injury. There appears to be a convergence of poor quality of care between inadequate pain management, unacceptable walking aids and immobilization. It would be important to determine whether quality of management is related to lack of knowledge, lack of resources or lack of time. A correlation between quality of care for musculoskeletal pathologies and amount of training has already been established²¹. Improving musculoskeletal training in medical school, family medicine programs, and continuing medical education activities may improve quality of care for these patients. If the problem is lack of resources or lack of time, these may also be addressed and improved. All Level 1 trauma centers should take a leadership role for the entire trauma system. Expert management of "minor" extremity trauma should be a part of this system as much as management of severe poly-trauma. The excellence of care should start with very simple things as immobilization, analgesia, walking aids and proper diagnosis of the injury.

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