Journal of Primary Care & Community Health
Volume 11: 1–6

DOI: 10.1177/2150132720967228
journals.sagepub.com/home/jpc
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Validation of the Primary Care Pathway Model for Management of Orthopedic Injuries: Results of a Prospective, Queensland Study

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Abstract

Objective: A "virtual fracture clinic" (VFC) is viewed as a safe, cost effective method of managing suitable low risk orthopedic injuries without direct orthopedic review. This method is used throughout the Glasgow Royal Infirmary (GRI) and National Health System (NHS) as a cornerstone for efficient patient care. This study assessed the outcomes of a newly implemented Queensland based Primary Care Pathway (PCP) for management of simple orthopedic injuries. **Methods:** A prospective cohort was formed of patients presenting over a 4-week period with an acute orthopedic injury to either the Emergency Department (ED) or Primary Care Providers within the Logan Hospital catchment in Queensland, Australia. Patients were triaged to either a PCP management protocol with General Practitioners (GP), Allied-Health Professionals (AHP) or to a traditional in-person Fracture Clinic (FC) orthopedic review. Patients were followed for 6-months. Data were collected about epidemiology, complications, appropriate allocation, and injury type. **Results:** A total of 1283 patients were referred over the study period, of which 267 were triaged to PCP management. ED referrals accounted for 62.5% of appropriate referrals to either clinic. Upper limb injuries were the most common conditions managed through the PCP. Patients managed by the PCP model of care experienced a 4.29% complication rate over the 6-month follow-up period. **Conclusion:** The PCP model of care is effective in managing criteria specific, low risk orthopedic injuries with a low rate of complications (4.29%) without direct orthopedic FC review. Use of a PCP reduces demand on hospital resources, and provides a safe, cost-effective alternative to a resource-restricted outpatient service.

Keywords

primary care, fracture, trauma, cost effectiveness, injuries, orthopedics

Received 16 August 2020; revised: 25 September 2020; accepted: 25 September 2020

Introduction

Musculoskeletal and connective tissue (MSK) pathology contributes to a significant number of emergency department (ED) presentations in Australia every year. In 2017-2018, MSK complaints accounted for 4.65% of the approximately 1.5 million ED visits in Queensland (QLD).[1] Since 2016, Queensland ED presentations have increased by 3.8% with an expected increase in demand for outpatient services.[1] Recent studies have demonstrated the ability of general practitioners (GP) and allied health professionals (AHP) to manage low-risk patients without orthopedic specialist input in fracture clinic (FC).[2]

In 2014, The Glasgow Royal Infirmary (GRI) successfully trialled a virtual fracture clinic (VFC), which demonstrated an effective collaboration between orthopedics and ED services to improve care for MSK injuries. VFC allowed for standardized referrals of low-risk fracture diagnoses to be

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Table 1. The Tool Index—Conditions Deemed Suitable for Primary Care Pathway (PCP).

Upper limb	Lower limb
Radius and ulna buckle fracture	Knee sprain
Midshaft clavicle fracture with no skin tenting and minimal shortening	Fibula buckle fracture
Metacarpal fracture with no significant angulation, displacement, or shortening	Metatarsal fracture—no significant angulation, displacement, or shortening
Elbow Injuries—supracondylar with no displacement, or anterior fat pad with no radiological evidence of fracture	Phalanx fracture—no significant angulation, displacement or shortening
First time shoulder dislocation	Weber A—no obvious talar shift
Volar plate injury w/ less than 25% of the articular surface involved	Tibia avulsion injuries—ligamentous injury
Mallet finger	Ankle sprain
Grade 1/2 Acromioclavicular joint sprain	First time patella dislocation with no obvious fracture
Radial neck fracture with no radial head dislocation or displacement	No injury found—no radiological evidence of fracture
Wrist sprain with no evidence of fracture	
Proximal humeral fractures in elderly with dementia	
No injury found—no radiological evidence of fracture	

made to primary care providers outside of the hospital setting. This resulted in significant benefits to ED time pressures and reduced unnecessary attendance of patients at in-person fractures clinics for review of stable, self-limiting injuries.[3] The service resulted in a significant reduction in specialist appointments for low-risk injuries and streamlined ED treatment pathways. This model of care has been supported by other studies. For example, a 2018 study evaluating a VFC for ankle fractures found improved patient satisfaction, clinical outcomes, and reduced resource strain within the public health system.[4]

VFC has many potential benefits. It provides favorable patient outcomes, decreases reliance on outpatient orthopedic staff, facilitates increased streamlining of diagnosis and treatment implementation, and is a resource-efficient method.[5-8] Research into the number of patients who could potentially be reallocated in Queensland has been limited. A physiotherapist-led VFC model was tested in a comparable Australian setting, which demonstrated positive patient outcomes when managing simple adult orthopedic fractures, further reducing demand for hospital clinic appointments.[9] A 2017 review of the number of presentations to FC at Logan and Redlands Hospitals (Queensland Health Metro South Health Service) over an 8-week period revealed that 40% of referrals made to FC would have met criteria for allocation and been suitable for redirection into the Queensland based Primary Care Pathway (PCP) model of care.[10] The PCP model implements a similar method to the VFC model seen successfully used by the GRI and the NHS, thus representing a type of VFC.

Therefore, using the template from the GRI, and following the previously validated VFC model of care outlined by the NHS (National Health Service), it is reasonable to hypothesize that in Australia, orthopedic patients who meet criteria can be safely and effectively managed within the PCP model of care. The aim of this study was to evaluate the complication rates and outcomes of implementing an existing VFC model in managing simple orthopedic fractures, without traditional face-to-face review in FC.[10]

Method

This prospective observational cohort study evaluated all FC and PCP referrals within Logan Hospital, Queensland, Australia between May 1, 2017 and May 30, 2017. Referrals were provided either externally from a community GP or internally from the ED, other specialty teams, or post-operative orthopedic units.

Both referrals to PCP and FC were reviewed prior to follow-up by an orthopedic registrar to ensure each referral was appropriately allocated via the "Tool Index" (Table 1), which outlines conditions deemed appropriate for PCP Management. Referrals were categorized into those which could be managed safely by GPs and AHPs through the PCP model of care, or those requiring orthopedics specialist review through the traditional FC pathway. This categorization utilized a multi-factorial approach, such as assessing the initial referral letter, reported mechanisms of injury, clinical consultation notes, official radiology report and review of available medical imaging. The "Tool Index" was determined by previous published data by the GRI plus additional low risk diagnoses. Referrals that met criteria for the PCP pathway were deemed inappropriate for FC and re-referred for PCP follow-up. Not all diagnoses deemed suitable for the PCP outlined by existing Queensland VFC model were included, with this study instead limited to the highest volume injuries.[10]

Patients were referred back to FC if there was inadequate information in the referral to make an accurate assessment, the diagnosed injury was incorrect, the X-rays were inaccessible, the patient had a cast in-situ or the diagnosed injury was not part of the PCP protocol (Figure 1).

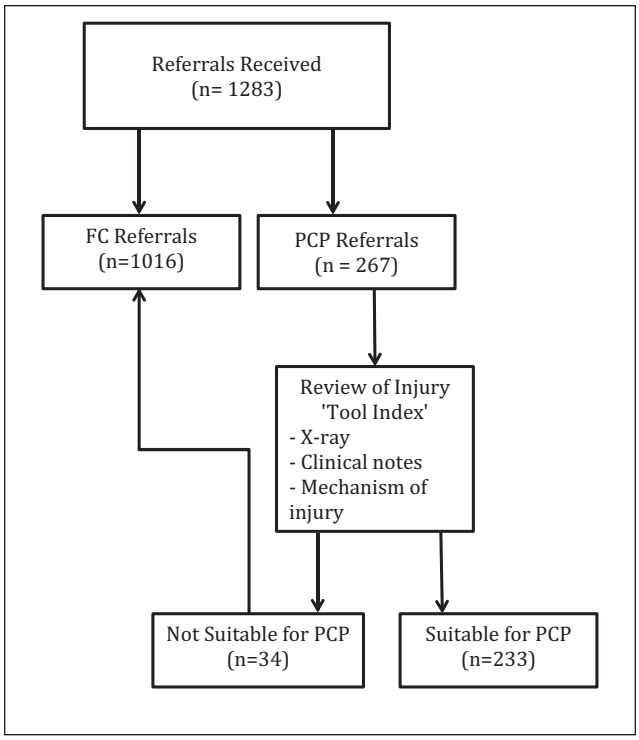

Figure 1. Selection criteria for PCP protocol.

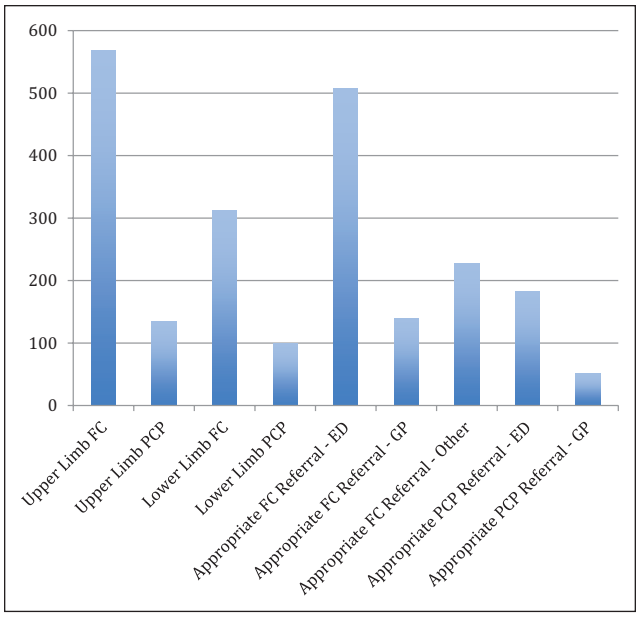

Figure 2. Referrals stratified by referral pathway and distribution (n = 1105).

ED staff were educated about the inclusion criteria of the PCP pathway prior to the implementation of the protocol, and patients who met inclusion criteria were educated on the follow-up protocol and given a fact sheet with relevant information regarding their provisional diagnosis.

Catchment GPs were given advice on education for patients with suspected PCP inclusion criteria diagnoses by a GP liaison officer.

All patients deemed suitable for PCP care were given a fact sheet about the diagnosed condition, which included information about the relevant anatomy, etiology, signs and symptoms, initial treatment, rehabilitation, potential complications. A corresponding letter was also sent to the GP. This letter outlined the follow-up plan, including X-ray requirements, recommended analgesia, allied health intervention, and discharge planning. PCP pathway patients were then followed-up in PCP clinic over 6 months, with appropriate follow-up intervals guided by their provisional diagnosis. If any complications were suspected throughout the patient's PCP participation, patients were immediately referred to FC for review.

All data were entered into the database program (Microsoft Excel) by either an orthopedic registrar or resident medical officer (RMO) under the supervision of an orthopedic registrar. Data were analyzed according to referral source, appropriateness of the referral (PCP or FC), limb involved (upper or lower), the diagnosis of the injury, age group of the patient (adult or child <16 years old), if the patient attended their clinic appointments, and any complications. Complications were determined based on whether the patient represented to hospital due to any ongoing issues while managed by the PCP pathway. These outcomes were chosen to further develop the PCP model of care by allowing for targeted educational strategies for referring clinicians based on the predominant presenting injury. Statistical analysis was performed on the failure-to-attend (FTA) rates using a 2×2 Fisher's exact contingency table.[11]

This study specifically analyses a time point in fracture clinic presentations post PCP implementation at Logan Hospital. Logan Hospital internal processes designed the PCP program independently.

Results

During the 4-week study period a total of 1283 referrals were received. 1016 patients were referred to FC and 267 patients were referred to PCP. FC received 872 (85%) appropriate referrals; and PCP received 233 (87%) appropriate referrals. 144 (15%) FC referrals were re-referred to PCP and 34 (13%) of PCP patients were recalled to FC. ED referrals accounted for 689 (62%) of the appropriate referrals in either clinic, 507 (58%) in FC and 182 (78%) in PCP. GP referrals accounted for 191 (17%) appropriate referrals, 140 (17%) seen in FC and 51 (22%) in PCP. ED referrals represented 107 (61%) of inappropriate referrals to either clinic, followed by GP with 64 referrals (36%).

There were 694 (63%) upper limb injuries seen in both clinics, and 411 (37%) lower limb injuries. Upper limb injuries made up 134 (57%), of referrals in PCP clinic (Figure 2).

Hand injuries (Volar plate, Metacarpal, Carpal, Phalanx) were the most common upper limb injury suitable for PCP,

Table 2. Adult Injury Presentations to PCP Over the Study Period (n = 112).

Upper limb injuries			Lower limb injuries		
Results	Number	% of total	Results	Number	% of total
Count total	55		Count Total	66	
Metacarpal fracture non-operative	22	40	Ankle injuries	32	48.5
No injury found	3	5.4	Metatarsal injuries	20	30.3
Phalanx hand non-operative	11	20	Phalanx—foot	13	19.7
Volar plate injury of finger non-operative	4	7.2	No injury found	1	1.5
Mallet finger	0	0	Failure to attend	0	0
Grade 1/2acromio-clavicular joint injury	2	3.6			
Elbow dislocation without fracture	0	0			
Elderly proximal humerus fracture non-operative	1	1.8			
Wrist/carpus non-operative	0	0			
Shoulder dislocation	0	0			
Failure to attend	0	0			

representing 64 (27%) of the total number of clinic presentations. Ankle injuries accounted for 32 (19%) and were the most common lower limb presentation followed by metatarsal fractures, which accounted for 20 (13%) of all PCP suitable presentations. The diagnosis of "no injury found" represented 4 (4%) of referrals to PCP (Table 2).

The study contained approximately an equal number of adult and children referrals suitable for PCP; 121 (52%), and 112 (48%), respectively. 616 (71%) of referrals to FC were for adults compared to 256 (29%) for children.

There were 147 failed to attend (FTA) referrals to either clinic, 147 (100%) to FC and 0 (0%) to PCP. 29 (32%) of FTA occurred in PCP-suitable patients who were incorrectly referred to FC. FC saw a decrease of 233 (22.9%) presentations over the study period.

Using a Fisher's Exact test with a contingency table for categorical data, a comparison between the FTA rate in FC patients from the Clearly et al.[10] study (pre-PCP pathway implementation) and the FTA rate in FC post PCP pathway implementation demonstrated a statistically significant result of the 1-tailed *P*-value of .0158.

Appropriate PCP suitable referrals experienced 10 (4.29%) complications over the 6-month follow-up period.

Discussion

The study demonstrated that 95.71% (233), of patients referred to the PCP pathway were managed successfully without any complications by GPs and AHPs. In cases where complications were recorded, these were related to miscommunication between the primary care providers and the patient in regards to ongoing management, or were related to inadequate analgesia. Any PCP patient who experienced complications was referred to FC for review. Due to this safety net system, only 1 patient experienced ongoing complications following this FC review. This patient required operative intervention for an unstable volar plate injury where an associated subluxation of the joint was missed, and represents a modification to the inclusion criteria of the PCP "Tool Index." This data shows that this subset of low-risk injuries (listed in Table 1) can be safely managed without orthopedic specialist input in a PCP model of care with an appropriate safety net system in place.

By demonstrating a low number of complications, the present study suggests that criteria-specific, low risk injuries can be managed successfully outside of the traditional FC model of care. PCP challenges the traditional FC method and facilitates an improved patient experience by empowering primary care providers with orthopedic advice and support. It reduces excessive medicalization of a subset of orthopedic injuries that have a favorable natural history. Implementation of a PCP pathway can help patients avoid hospital attendance and significantly reduce the resource burden on oversubscribed FCs. Compared to traditional FCs, 233 initial outpatient FC attendances, along with the subsequent follow-up appointments, were avoided. Therefore, the implementation of PCP saw a reduction of 22.9% in the number of patients presenting to FC over the study period. This is consistent with the findings by previous VFC literature, which demonstrated that 40% of patients referred to FC were suitable for a PCP model of care over an 8-week study period.[10] This reduced the workload of orthopedic FCs, which allowed more time for complex patient presentations and gives primary care providers a more direct involvement into the management of their patient's acute injury.

A 2017 study reviewing radiographs in children with distal radius buckle fractures demonstrated the potential cost saving of avoiding unnecessary radiography in stable pediatric fractures.[12] The positive financial impact was not assessed in this study but would be worthwhile to consider in future studies of the PCP model. The findings of this study support involvement of primary care clinicians and allied health services in the management of

suitable orthopedic injuries by demonstrating favorable outcomes and reducing the demand on in-hospital specialist services.

The next step in the process of developing and validating this model of care is to liaise with the healthcare providers involved including GPs, AHPs, and outpatient departments with the aim of implementing a follow-up protocol to assess the functional outcomes and patient satisfaction after receiving PCP management. Currently, at Logan Hospital, no guidelines regarding the assessment of functional outcomes of these patients has been established. With formal guidelines to support GPs and AHPs, more accurate predictions into the functional outcomes of their patients can assist the treating practitioners into managing MSK injuries in the absence of specialist input.

A 2015 study reviewed patient satisfaction and functional outcome for the management of fifth metacarpal fractures in patients who were referred to VFC via an ED implemented pathway.[13] The study used the patient-reported outcome tools QuickDASH and EQ-5D. The QuickDASH system uses 11 items to measure physical symptoms and function in patients with upper limb MSK disorders. The EQ-SD is a generic standardized instrument used to measure health related quality of life, which can be used for a diverse patient group independent of underlying disability or disease.[14] Their study demonstrated comparable patient satisfaction levels and patient-reported outcomes measures between the VFC model and traditional management approaches.[13]

For long-term application of the PCP model of care, future studies looking at implementing a system to review the functional outcomes and patient satisfaction at Logan hospital for suitable orthopedics injuries would require GPs and AHPs to undergo continuing education. This would need to include ED information sessions led by the orthopedic department and direct liaison with GP practices and Allied Health services within the Logan Catchment Area. Similar to previous literature on patient satisfaction and functional outcomes measurements, all cases referred would have their X-ray radiographs, functional outcomes and patient satisfaction scores review by a member of the orthopedic consultant team and referred to FC if required.[13] All patients and referrers would be provided with the contact details for the on-call PCP orthopedic registrar should they have any questions or concerns. Finally, patients who are unable to participate for any reason would still be offered an appointment at traditional FC. This would ensure minimal patient complications while allowing an assessment of patient functional outcomes.

Limitations

This study found that PCP suitable patients had a complication rate of 4.49%. This was determined by re presentations to hospital. If patients presented to other health facilities using different electronic medical record systems, their complications might have been missed. With the on going expansion of electronic medical records, and the continued improvement of the PCP pathway, we expect to be able to capture a greater proportion of re-presentations in the future.

During the study period, there was a reliance on the primary care providers to perform adequate assessment and order correct X-ray in order to facilitate sufficient information for patients to be triaged appropriately for PCP pathway. ED represented the majority of inappropriate referrals to FCs, and while ED information sessions conducted by orthopedic consultants were held prior to implementation of the study period, ED is an often overwhelmed and understaffed area within the Hospital Service. Limitations to education exposure, decision-making time, and discussion with senior colleagues hinder the ability to facilitate appropriate referrals in a newly implemented system. This may have led to a misdiagnosis of injury and inappropriate allocation of patients to PCP. Furthermore, variation of ED staff shifts, frequent turnover of junior medical staff and existing referring habits of EDs and GPs may all contribute to patients having inadequate information on referrals, excluding them from the PCP and necessitating referral to traditional FCs for follow-up.

The total FTA during the study period was 11%, which is similar to the findings in the preliminary PCP study, which demonstrated an 11% FTA rate of all attendance.[10] Interestingly, 100% of the referred patients who eventually failed to attend were referred to FCs, while those referred to PCP did not miss a follow-up. This most likely represents a transfer bias as patients may have more motivation to attend their appointment based on their knowledge of participation in a recently implemented system.[15]

Conclusion

The present study has demonstrated that select orthopedic fractures can be managed successfully outside of the traditional FC model of care by primary care providers without direct orthopedic specialist input. The PCP model of care had a low complication rate, provided a reduction in FC attendances and facilitated effective re-allocation of hospital resources. Other studies have shown successful functional outcomes and patient satisfaction with a similar model of care. Further enquiry into these outcomes will be the next step in validating this model of care in a local Queensland setting.

Acknowledgments

The authors thank Lech Rymaszewski, Consultant Orthopedic Surgeon, Glasgow Royal Infirmary, Scotland, Paul Jenkins, Consultant Orthopedic Surgeon, Glasgow Royal Infirmary,

Scotland, and Nick Shott, Consultant Orthopedic Surgeon, Logan Hospital, Australia.

Author Contributions

CF was involved in research, formulating results and wrote final report and revisions. TB was involved research and data collection. CS was involved in editing the report. MS was involved research and data collection. LQ was involved research and data collection. AC designed the study and supervised the research.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

Ethical Approval

The present study was exempt from ethical approval after local hospital ethics review (HREC/16/QPAH/543: a multicenter retrospective audit of fracture clinic presentations at Logan Hospital—except 22 July 2016—Metro South National Health and Medical Research Council [NHMRC]).

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