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An analysis of virtual fracture clinics in orthopaedic trauma in the UK during the coronavirus crisis

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- Virtual fracture clinics (VFC) are advocated by new orthopaedic (British Orthopaedic Association) and National Health Service (NHS) guidelines in the United Kingdom. We discuss benefits and limitations, reviewing the literature, as well as recommendations on introducing a VFC service during the coronavirus pandemic and into the future.
- A narrative review identifying current literature on virtual fracture clinic outcomes when compared to traditional model fracture clinics in the UK. We identify nine relevant publications related to VFC.
- The Glasgow model, initiated in 2011, has become the benchmark. Clinical efficiency can be improved, reducing the number of emergency department (ED) referrals seen in VFC by 15–28% and face-to-face consultations by 65%. After review in the VFC, 33–60% of patients may be discharged. Some studies have shown no negative impact on the ED; the time to discharge was not increased. Patient satisfaction ranges from 91–97% using a VFC service, and there may be cost-saving benefits annually of £67,385 to £212,705. Non-attendance may be reduced by 75% and there are educational opportunities for trainees. However, evidence is limited; 28% of patients prefer face-to-face consultations and not all have access to internet or email (72%).
- We propose a pathway integrating the VFC model, whilst having senior orthopaedic decision makers available in the ED, during normal working hours, to cope with the pandemic. Beyond the pandemic, evidence suggests the Glasgow model is viable for day-to-day practice.

Keywords: fracture clinic; orthopaedics; virtual fracture clinic

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Introduction

The current SARS-CoV2/COVID-19 pandemic is a national emergency in the UK. Pathogen virulence and global spread has overwhelmed the medical infrastructure of many developed nations.[1,2] The current crisis has stimulated further development of safe 'hospital distancing' care for many injuries in a short space of time.

Within trauma and orthopaedics, the British Orthopaedic Association (BOA)[3] and NHS England[4] have released updated guidelines for practice, to ensure care is appropriately delivered during the pandemic. Two of the new BOA Standards for Trauma (BOAST) guidelines[3] have led to this review, namely:

1. Patient-initiated follow up should be the default, with booked appointments only where this is unavoidable.
2. Follow-up appointments should be delivered by telephone or video call if at all possible. Existing appointments should be cancelled, postponed or conducted remotely.

Many orthopaedic departments in the UK have begun or expanded an existing virtual fracture clinic (VFC) service during the pandemic.[5,6]

Currently, 51 units in the British Isles have a fully implemented VFC model.[7] Virtual fracture clinics have been used by other specialities, such as renal medicine, gastroenterology and ophthalmology for some time but their uptake in trauma and orthopaedics has been slow.[8–10]

The most notable was established in the Glasgow Royal Infirmary[11] as well as Brighton and Sussex.[12] The BOA published a statement on their website in 2015 'welcoming research into all aspects of improving patient care and

encouraging publication of the results of such trials of new fracture clinic models'.[13] Additionally, the National Institute for Health and Care Excellence (NICE) in 2016 highlighted the importance of research comparing VFC to traditional fracture clinics. They concluded there was a need to understand 'the clinical and cost-effectiveness of virtual new patient fracture clinics compared with consultant-led face-to-face clinics in people presenting with non-complex fractures'.[14] We identified nine publications to date that have studied the outcomes of introducing a fully implemented VFC model, when compared to a traditional model in the UK.[11,15–22]

The aim of this article was to review the evidence regarding VFCs in the context of the current coronavirus (COVID-19) pandemic in the UK. Furthermore, this article is the first to review the evidence regarding the current use of VFCs to our knowledge. We review the benefits and limitations of the VFC and suggest a model based on the evidence as to how the clinic may be successfully implemented during the pandemic and beyond.

Background

Initial attempts at, 'virtual' or 'telecommunication' fracture clinics focused on the use of multi-media messaging or 'teleradiology' where specialists provided advice based upon radiograph imaging of an injury.[23-26] As technology has improved, the use of a full virtual consultation with a history, examination, analysis of imaging and discussion between the specialist and patient from a remote location using video conferencing has become the gold standard. Forms of telecommunication for virtual orthopaedic services have notably been trialled in Europe, Australasia and North America. In Europe, telecommunication in orthopaedics has been used as early as 1999 in Finland,[27] with 87% patient satisfaction. It has also been used in Ukraine, where it was particularly useful for polytrauma patients[28] and in Norway in a randomized control trial.[29] Australia recognized the potential benefits of a VFC service as early as 2011,[30] to reduce patient travel in such a vast country. A snapshot review of telecommunication services in orthopaedics in Australia in 2017 revealed 10 departments running a telecommunication service, of which five ran a VFC service.[31] In America, institutions such as the US Army have been quick to realise the potential of a VFC service when deployed in remote, austere locations.[32] As well as civilian orthopaedic services in America from as early as 1998.[33,34] In the UK, until relatively recently the delivery of outpatient fracture care has not changed significantly since guidelines were set by the British Medical Association in 1935.[35] The general understanding of the fracture process within orthopaedics as well as the technology available, has advanced significantly since then. Whereas patients traditionally attended fracture clinics at regular fixed periods, the modern emphasis is to attend only when and where necessary, to reduce therapeutic inertia. During the COVID-19 pandemic, the aim is to reduce face-to-face appointments, therefore a safe alternative must be sought at this time.

In England, 1.8 million fractures occur annually with a lifetime prevalence of nearly 40%,[36] whilst 4.6% of all emergency department (ED) attendances are represented by dislocations, joint injuries, fractures and amputations. During the COVID-19 crisis, demand has further increased on already busy ED departments. These factors have created prolonged waiting times, which in conjunction with sub-optimal management at the time of injury, can lead to patient harm. During the pandemic, the BOA has advocated non-operative treatment of fractures where possible (particularly upper limb) with delayed reconstruction if required. Therefore, many injuries, if correctly assessed at presentation, can be successfully discharged if appropriately dealt with by a senior orthopaedic clinician, rather than staff in the ED department.

BOAST guidelines were introduced for fracture clinic services in 2013 by the BOA. The most challenging guideline (BOAST 7) stipulated that patients should be seen in a new fracture clinic within 72 hours of presenting to the ED.[3] Virtual fracture clinics were originally set up to try to meet this BOAST 7 guideline from a financial perspective. In the climate of the current pandemic, they also provide a method to eliminate and reduce face-to-face appointments, thereby promoting safe 'hospital distancing'.

The Glasgow model

The Glasgow Fracture Pathway has become the benchmark for NHS trusts considering fracture clinic redesign and their successes have been widely published.[11,15,16,18,37-42] Begun in 2011, prior to BOAST 7, the orthopaedic team worked closely with the ED to redesign management pathways of non-operative fractures. All patients presenting to the ED are either referred for orthopaedic urgent intervention, or allocated to one of two pathways.

The first is for patients with simple, self-limiting stable fractures as selected by prior searching of an evidence base. These include fifth metatarsals and metacarpals, mallet fingers, distal radius, elbow fat pad sign or child's clavicle.[11] Such cases are given both verbal and written advice directly in the ED, prior to discharge without follow up. The written advice explains the injury, treatment plan and expected recovery whilst also including a helpline phone number as a safety net. Current BOA guidelines during the COVID-19 pandemic advocate this 'discharge at presentation' model. This should, however, be led by a senior orthopaedic clinician rather than the ED as per the 'Glasgow model'.

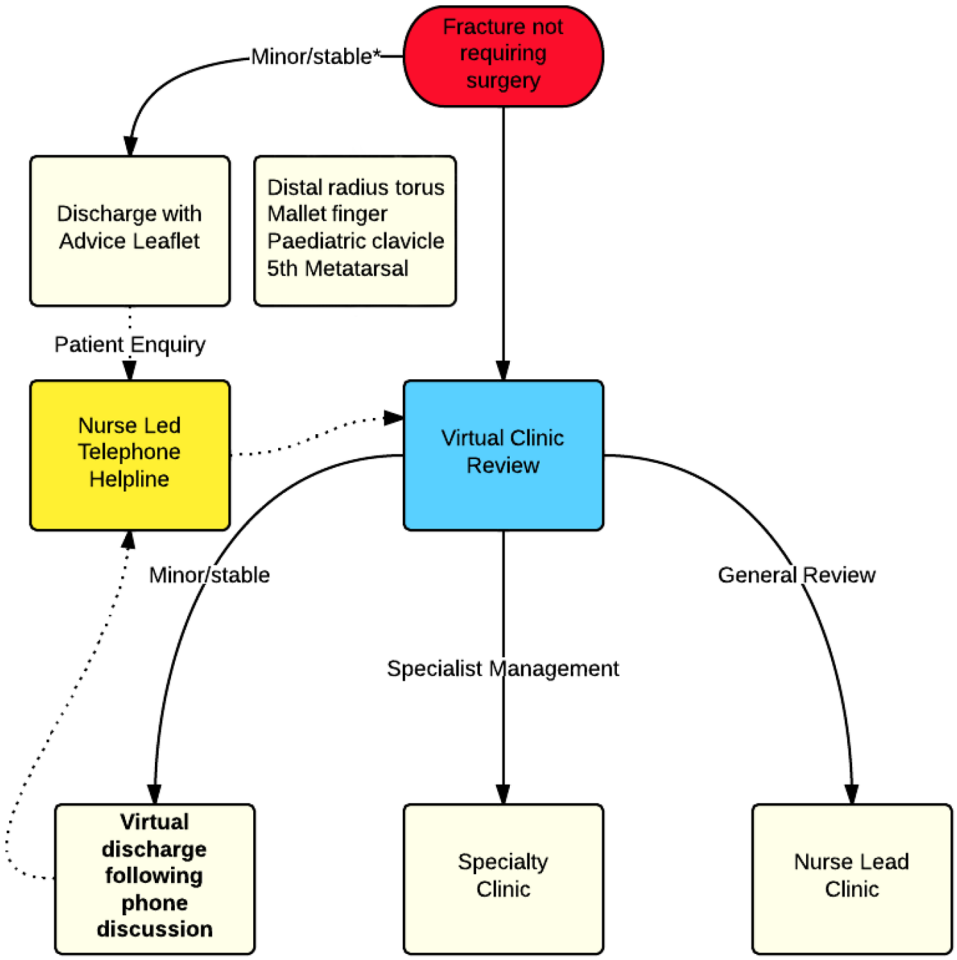

Fig. 1 The Glasgow model. Reproduced courtesy of http://www.fractureclinicredesign.org/, with consent from Consultant Paul Jenkins by email and the Glasgow team in charge of website.[7]

In the second pathway, those who are not suitable for complete discharge or admission are referred to the VFC. The VFC is a regular (daily) multi-disciplinary meeting led by an orthopaedic consultant who, on reviewing ED notes and ED radiographs, can allocate patients to be discharged after telephone advice, to be reviewed in a nurse-led fracture clinic or to be seen in sub-speciality clinics.

To provide a safety net for the ED, false positive (overly cautious) referrals are managed by telephone conversation and reassurance, and false negatives (missed injuries) mitigated with timely reporting of ED radiographs with effective recall systems. Current BOA advice at the time of the pandemic encourages video or telephone consultation follow up, rather than a face-to-face clinical appointment. Patient-led follow up rather than formal booked appointments at this time is preferable. We thus suggest at this initial virtual assessment point deciding between nurse, orthopaedic surgeon or physio-led telephone clinic for further follow up if required (Fig. 1).

Clinical efficiency

The idea of the VFC was that patient appointments would be limited to only the most productive; namely those where assessments or treatment would be instated by the appropriate sub-specialist clinic at a suitable time. This thereby increases the clinical efficiency within the fracture clinic. It has been shown in the literature that the immediate effect of an implemented VFC service is a reduction in the number of ED to fracture clinic referrals by between 15% and 28%.[15,17,43] Additionally, 55–67% of ED referrals that would have been seen in a traditional fracture clinic, were appropriate to be seen in the VFC.[11,21] Anderson et al showed a 65% reduction in face-to-face consultations in a fully implemented VFC service.[16] Other literature shows 27–29%[11,19] of patients being referred on to sub-specialty clinics from the VFC, 38% to physio[19] and 6%[11] to nurse-led clinics.

The overall discharge rate after review in the VFC ranges greatly from 33% to 60%[11,17,19] who did not require

any formal fracture clinic appointment or further review. The percentage of patients meeting the BOAST 7 guideline (seen within 72 hours in clinic from the ED), ranges from 46%[17] to 100%[22] in the literature. During the current coronavirus pandemic, timely decision making and intervention are key. Evidence suggests that VFCs can achieve this safely while adhering to the emergency advice set out by the BOA at this time. This has also increased the time clinicians can dedicate to patients within the VFC and has shown increased time per patient.[17] In addition to clinicians, it has been shown to increase time per patient for the nurses, administration staff and typists within fracture clinic services.[16] With fewer referrals to face-to-face fracture clinics and improved waiting times from referral to first orthopaedic review in clinic, this ensures more timely management decisions are made.[17] At a service level, significant benefit was derived from freeing up clinical and administrative time.[11] This is particularly important during the COVID-19 pandemic where as much as possible should be done to make healthcare professionals' daily work more time efficient.

Some studies have focused on the outcomes of management in specific orthopaedic injuries through VFC. This helps to expand the overall scope of injuries that can be managed safely through a VFC model, with local agreed treatment protocols. This will increase the overall clinical efficiency of VFC models. There is good evidence that fifth metatarsal fractures maybe managed through a VFC model.[44,45] Ferguson et al showed that fifth metatarsal fractures could be managed effectively at first contact in the ED without further follow up.[39] Other injuries that have been shown to be effectively managed through a VFC model are: fifth metacarpal fractures,[40] clavicle fractures,[46] mallet finger injuries,[41] ankle fractures[47] and paediatric fractures.[48] Research in this area thus suggests that many of the injuries described in the current BOA pandemic advice have been previously successfully managed using the VFC model.

Impact on the ED

To reduce unnecessary variation, most VFC studies agreed standardized protocols at point of contact in the ED for simple injuries with treatment plans such as removable splints.[49–51] These agreed guidelines (between the ED and orthopaedic departments) ensure that their decisions are appropriate and consistent, reducing the requirement to seek advice from ED seniors and orthopaedic staff.

Despite the concern that these protocols could lead to 'frontloading' of the ED, Vardy et al showed that ED performance was not adversely affected by the introduction of a VFC process. The time to discharge was not increased as a result of having to provide definitive explanation and advice.[18] However, during the current COVID-19 pandemic, there is unprecedented demand upon ED departments.[1,2] Therefore, to reduce the burden, updated NHS guidelines have been released advising that a senior orthopaedic decision should be available at point of contact in the ED.[4]

BOA COVID guidelines have advocated the use of removable splints rather than plaster where possible to reduce subsequent fracture clinic follow up burden. Furthermore, evidence suggests that this can reduce the total time a patient spends in the ED, particularly in the management of radial styloid and stable ankle fractures.[18]

Patient satisfaction

Patient satisfaction for recovery using a VFC model of care varies in the literature from 91–97%,[19,20,46] from studies including 138–2704 patients. Satisfaction with the information provided varied from 86% to 95%.[42,46] Evidence suggests a good acceptability and satisfaction amongst patients which is likely to be much higher in the current crisis where 'hospital distancing' is key for patients, particularly for those who are most vulnerable.

Cost savings

One of the main driving factors to initiate VFC models across the UK was cost saving within the NHS. The annual reported yearly savings from implementing a full VFC service, when compared to a traditional model, vary from £67,385 to £212,705 in the literature.[11,15,17] Anderson et al calculated the cost per patient was reduced from £36 to £22[16] and O'Reilly et al calculated the cost decreased from €129 to €28.[19] Jenkins et al predicted that national adoption of the redesigned fracture pathway may have resulted in a cost saving of £3,535,808 over the time period (2009–2014).[15] Any cost savings at the time of the current pandemic and national economic crisis would be beneficial to the NHS both in the short and long term, given the economic impact of the pandemic.

Non-attendance

The non-attendance rate nationally for all outpatient appointments in NHS England is 8.8%.[52] There is limited research on the overall non-attendance rate within fracture clinics, it has previously been reported from 3.5% to 7.3%.[53,54] This has significant implications in terms of cost and use of resources. McKirdy and Imbuldeniya showed that six months after a VFC introduction there was a 75% reduction in non-attendance.[17]

Impact on trainees

Despite concerns that VFC may reduce learning opportunities for trainees, there is evidence that the extra time that

consultants have as a result, leads to a better learning environment that is less stressful than traditional models.[55–57]

VFC limitations

The development of simple evidence-based local treatment protocols with consensus between EDs and orthopaedic departments is one of the biggest challenges in setting up VFC models nationally.[11] As discussed before, some articles have focused on the management of individual injuries to increase this evidence base, such as fifth metacarpal fractures.[40] As this evidence base increases, more and more injuries will be incorporated into the VFC model, expanding local protocols for treatment, which will greatly increase the overall efficiency of the VFC system and the spectrum of injuries that can be treated safely through these protocols.

Few studies detail negative aspects of the VFC model. Most of the study's authors were the founders of the VFC models in their own units, introducing publication bias. Feedback when setting up a new VFC model, was recognized as critical to continually refine and improve the service between the ED, orthopaedic departments and all staff involved from clinicians to nurses and administration staff.[21] Breathnach et al noted that 28% of the participants would have preferred a face-to-face model and two participants returned to their GP/ED for further pain relief and advice.[20] In self-care protocols for injuries, Brooksbank et al noted that seven of the mallet injuries studied were reviewed by the general practitioner or other clinicians during their treatment.[41] In the pioneering unit for the virtual model, there are currently no medicolegal cases reported, after having managed 30,000 patients.[16]

Another important limiting factor with the VFC model is internet access. In one study, 72% of the patients reported having internet access.[38] Lack of access was associated with socioeconomic deprivation and older age. The lack of internet access, particularly in the elderly population, highlights that there must still exist a traditional model, as a backup, working in conjunction with the newer VFC models. Telephone, particularly landlines, in the older population is still an important technological modality to be used for 'virtual' follow up. This is of particular relevance when one considers that COVID-19 has been shown to affect predominantly the elderly population.[1,2]

Recommendations

Whilst in this current state of national emergency, we propose incorporating both the NHS clinical guidelines for the management of trauma and orthopaedic patients during the coronavirus pandemic[4] as well as the principles of outpatient management from the updated BOAST guidelines.[3]

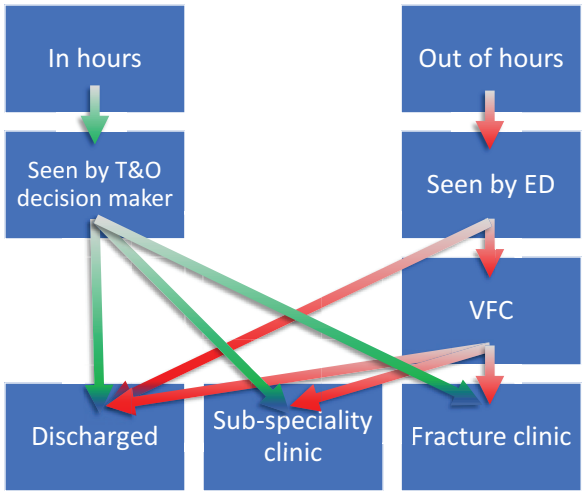

Fig. 2 Proposed pathway during the pandemic.
Note. In hours, 0800–1700. T&O, trauma and orthopaedics; ED, emergency department; VFC, virtual fracture clinic.

Despite the limitations described in this article, VFCs offer a safe way to help manage the current UK trauma burden whilst adhering to the national COVID-19 pandemic guidelines. We propose the model shown in Fig. 2.

Emergency departments are under extra strain during the pandemic.[1,2] In addition to a potential increase in the number of patients seen in the ED, staff must take extra precautions. This means that 'use of personal protective equipment (PPE) in emergency and acute admission areas may be indicated regardless of case status of patients, subject to a risk assessment'.[58] This is an additional burden on staff working in the ED. Having a senior orthopaedic decision maker in the ED, in working hours, as per the above protocol, will help to reduce to the strain on the ED during the pandemic.

Based on the current evidence we propose telephone consultations are the most reliable way of conducting the VFC at time of the pandemic.[11,17,19,39–41,46]

BOA guidelines at time of pandemic suggest delayed surgical intervention may be required and is currently accepted practice. Consultants triaging the VFC may be able to manage more fractures than previously during the pandemic conservatively, with no immediate follow up.

Beyond the pandemic, the evidence suggests that VFC is a viable model that should continue to be introduced into the remaining traditional fracture clinic models still running in the UK. It is important to note that current evidence is limited, despite being introduced since 2011. This is the first review of the literature to our knowledge and suggests there is a need for more prospective level one and two research on the VFC model, both nationally and internationally.

Conclusions

The pandemic is likely to lead to many changes in the workplace, both within and outside of medicine, and is likely to accelerate the change in VFC modelling at a national level. Beyond the pandemic, we suggest the VFC model, as introduced in Glasgow, is a viable model (see Fig. 1). This is likely to increase clinical efficiency, reduce impact on the ED, increase patient satisfaction, reduce non-attendance and produce cost savings. The use of robust treatment protocols and algorithms at the point of contact in the ED is likely to relax the need for a senior orthopaedic decision for all trauma and orthopaedic clinic referrals in the ED after the pandemic, without negatively impacting upon the performance of the ED or affecting patient safety.

There is a need for further evidence on this subject and, in particular, to expand our evidence base for the management of specific injuries through protocols agreed with and led by orthopaedic sub-speciality societies, the BOA and the Royal College of Emergency Medicine, to slipstream care. Greater collaboration on a national and international scale, would accelerate this process and further increase clinical efficiency.

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