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Hand

Cost-reduction Analysis of Percutaneous Pinning of Hand Fractures in an Outpatient Clinic

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Background: The University of Sherbrooke's Hospital Center operating room has been affected by the COVID-19 pandemic, prompting surgeons to seek alternative ways to treat acute injuries requiring surgery. In the spring of 2020, we began performing percutaneous pinning of hand fractures in our outpatient clinic. We aimed to estimate the savings in 2021 by transferring these procedures from the operating room to the outpatient clinic.

Methods: We identified all patients with hand injuries who received percutaneous pinning in 2021 using billing codes. Only patients treated in the outpatient clinic were included. We estimated the cost of hand fracture fixation in the operating room by considering the anesthesiologist's fee, the hospital's hourly rate for a 1-hour surgery (including a respiratory therapist, 2 nurses, and equipment) and salary bonuses for unfavorable hours, subtracting the cost difference of outpatient equipment.

Results: We identified 114 patients treated with percutaneous pinning, of whom 93 were included in our study. Our calculations showed a total cost reduction of CAD $55,789 in 2021.

Conclusions: Percutaneous pinning of hand fractures in an outpatient setting resulted in a yearly cost reduction of more than CAD $55,000. Investing in ambulatory care for hand fracture management benefits both patients and institutions.
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INTRODUCTION

The University of Sherbrooke's Hospital Center has not been spared the impacts of the COVID-19 pandemic. Access to the operating room (OR) was reduced, complicating the scheduling of emergency cases. This issue led many surgeons to find alternative ways to operate on patients presenting with acute injuries requiring surgical intervention. In our center, in the spring of 2020, we began performing percutaneous pinning of hand fractures in the outpatient clinic using a mini C-arm.

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Hand fractures requiring closed reduction and percutaneous pinning (CRPP) have been managed either in an OR setting under a regional block or general anesthesia, or in an ambulatory setting under local anesthesia. In Canada, the majority of plastic surgeons opt for an in-OR procedure, shying away from performing wide awake local anesthesia no tourniquet (WALANT) under fluoroscopy.[1] The current literature shows that ambulatory procedures reap many benefits such as cuts in spending and increase in efficiency[1–5] with no significant difference in complication rates.[4–9]

In our center, hand trauma consultations are seen in an outpatient clinic, generally within 24 hours. When surgery is indicated and K-wire fixation is deemed appropriate, the patient undergoes pinning immediately at the clinic with the current staff available. Therefore, no additional personnel is required. On busy days, the patient may be asked to return at the end of the day to undergo the procedure. No fasting is required.

In 2021, the majority of our percutaneous fixations were completed in the outpatient clinic. The main objective of this study is to estimate the money saved in 2021 by performing our CRPPs in an outpatient clinical setting instead of the main OR.

Disclosure statements are at the end of this article, following the correspondence information.

METHODS

We identified patients of all ages with an acute hand injury who underwent a CRPP procedure between January 1 and December 31, 2021 at the University of Sherbrooke's Hospital Center. These patients were traced back using billing codes related to CRPP that were submitted by 4 attending plastic surgeons covering hand trauma calls. We reviewed electronic patient files and included only patients whose procedure was performed in clinic. We estimated the cost of a hand fracture fixation procedure completed in the OR by taking into consideration the following items: the anesthesiologist's fee; the hospital's hourly rate for a 1-hour hand surgery under regional anesthesia (which includes a respiratory therapist and 2 nurses, as well as required equipment); and the subtracted the cost of the material used in the outpatient clinic. It should be noted that there were no fees regarding the use of the clinical space and no additional nursing involved when procedures were performed in clinic. Both procedures are very similar in terms of asepsis and draping and are located within the same hospital.

In our center, hand trauma cases requiring use of the main OR are booked on the emergency list, which typically runs from 8:00 AM until midnight seven days a week. This list is an OR that operates separately from elective cases and therefore has an unpredictable schedule that varies depending on emergencies. According to the provincial billing system, a bonus fee is applied for surgery taking place during unfavorable hours (ie, weekdays after 7 PM and anytime during weekends). This bonus was considered as we calculated salaries for the respiratory therapist, nurses, and an anesthesiologist. Given the organizational system at our hospital, the use of the OR is always for major procedures performed with an anesthesiologist, 2 nurses, and a respiratory therapist. Thus, surgery under local anesthesia is rarely performed in the OR. We recognize that this institutional way of proceeding may not be applicable to all centers.

RESULTS

According to billing codes, we identified 114 patients who underwent a CRPP procedure in 2021 at our center. After reviewing patient files, we noted that 21 cases were performed in the main OR due to clinic ineligibility (patient anxiety toward procedure done under local anesthesia, or severe trauma necessitating a main OR setting), and thus were excluded. Hence, 93 patients were included in this study. In all cases, a phalangeal or metacarpal fracture was present and considered the main pathology.

The hospital provided us with the hourly rate (cost) for a hand surgery case considering the basic instruments required. This fee of CAD $410 includes the salary of a respiratory therapist as well as 2 nurses, which is the minimum staff required to run a main OR.

In the province of Quebec, the anesthesiologist's fee is calculated by adding 2 components (which are obtained by multiplying by their respective unit rates): the basic units and the sum of the duration units. A percutaneous pinning of the hand equals 6 basic units and 4 duration units, as we consider them as an hour-long surgery on average. In 2021, each unit was worth CAD $17. Thus, CAD $170 was considered per case.

The salary bonus was considered for a quarter of our CRPP cases. From our hospital OR database of the previous year, we estimated that 25% of our CRPP cases were performed during unfavorable hours. Regarding the anesthesiologist's bonus, the Régie de l'assurance maladie du Québec (RAMQ) billing system allotted them an additional 70%. We thus considered this bonus for 25% of the cases and obtained a total of CAD $18,577 in anesthesiologist fees. The nurses' and respiratory therapists' salaries are included in the hourly rate provided by the hospital system. Regarding unfavorable hours, a ratio had to be considered. Hence, we applied the fee for registered nurses in Quebec provided by the Government of Canada as an estimate.[10] It was then considered that the 50% salary bonus for 25% of the cases would apply to the CAD $35 an hour fee, giving a total of CAD $1221.

Considering cost difference related to the instruments used, items both required in the OR and the clinic were disregarded, as these did not impact cost difference (Table 1). The basic items required for hand surgery are included in the fixed hourly rate of CAD $410 but also used in the outpatient clinic (Table 2). Because the fixed cost in the main OR also includes staff salary, we could not use this rate in the cost of procedures performed in the clinic. We thus extracted from the fixed rate the cost of all elements required in the clinic to obtain a more accurate cost difference (Table 3).

Taking into consideration these data, we have estimated a cost reduction of CAD $55,789 in 2021 for our center (Table 4). This corresponds to a cost saving of approximately CAD $613 per patient.

Takeaways

Question: What are the economic benefits associated with performing hand closed reduction and percutaneous pinning (CRPP) outside the main operating room (OR)?

Findings: The costs associated with a hand CRPP case taking place in the OR and in an outpatient clinic were evaluated. Fees for required material and labor were considered. An important reduction in costs was calculated, enough for our center to reimburse a new mini C-arm in just 2 years' time.

Meaning: It is very feasible and cost-efficient to perform hand CRPPs outside the main OR.

DISCUSSION

By performing the vast majority of percutaneous fixation of metacarpal and phalangeal fractures under mini C-arm fluoroscopy in the outpatient clinic, we estimated a cost reduction of CAD $55,789 when compared to the

Table 1. Items Considered in the Cost Difference Calculation

Costs Considered in the OR	Costs Considered in the Outpatient Clinic
• ~~Surgeon's fee~~	• ~~Surgeon's fee~~
• Instrument tray sterilization	• Instrument tray sterilization
• Dressing material	• Dressing material
• Anesthesia equipment	• Local anesthesia equipment
• Material for sterility	• Material for sterility
• ~~Expenses related to the outpatient clinic visit~~	• ~~Expenses related to the outpatient clinic visit~~
• ~~Kirschner wires~~	• ~~Kirschner wires~~
• ~~Fiberglass splint~~	• ~~Fiberglass splint~~
• ~~Mini C-arm drapes~~	• ~~Mini C-arm drapes~~
• Nursing staff salary	
• Respiratory therapist's salary	
• Anesthesiologist's fee	
• Recovery room staff	
• Room cleaning	
• Day surgery staff/recovery room	

Crossed out elements are not included in the fixed hourly rate but are required in both settings and thus were not calculated in the cost difference, as they even out.

Table 2. Items Considered in the Cost Difference Calculation (Continuation)

Costs Considered in the OR	Costs Considered in the Outpatient Clinic
• Instrument tray sterilization	• Instruments trays sterilization
• Dressing material	• Dressing material
• Anesthesia equipment	• Local anesthesia equipment
• Material for sterility	• Material for sterility
• Nursing staff salary	
• Respiratory therapist's salary	
• Anesthesiologist's fee	
• Recovery room staff	
• Room cleaning	
• Day surgery staff/recovery room	

Left column: Items included in the fixed hourly rate. Right column: Items that have to be extracted and calculated in the outpatient clinic cost as they are included in the hourly rate when the procedure is done in the operating room.

Table 3. Unit Cost for Materials to be Calculated for Outpatient Clinic Costs

• Syringe 10 mL: $0.09
• 25 G needle: $0.03
• Xylocaine 2%: $5.83
• Sterile drape: $3.88
• Sterile gown: $3.37
• Sterile gloves: $3
• Chlorhexidine sponges: $5.30
• Bactigras: $0.97
• Bandage Kling dressing: $0.45
• Elastic dressing: $0.75

relative costs of the main OR. This study is the first cost-reduction analysis of its kind in the province of Quebec and provides potential insight with regard to reorganization of resources and potential improvement of efficiency considering the current state of the healthcare system in Quebec. Low staff, heavy caseloads, overrun centers, and high wait time are recurring pitfalls in our hospitals.[11] These problems can translate into other Canadian provinces as well as other countries.

As for cost reduction, in a 2017 cost analysis performed in Nova Scotia, calculations estimated a 299% increase in

Table 4. Summary of the Results

No. patients	93
Duration of procedure (h)	1
Hourly rate (S)	38,130
Unfavorable hours bonus	1221
(50% salary bonus for nurses and RT for 25% of the cases)	
Anesthesiologist fees ($)	18,577
Subtotal ($)	58,021
Outpatient clinic material ($)	2232
Total ($)	55,789

$, Canadian dollar (CAD); RT, respiratory therapist.

expenses when comparing percutaneous pinning of hand fractures in the OR under local anesthesia (CAD $461.27) to those done in an ambulatory setting (CAD $115.59). Under regional block, costs would further increase by an outstanding 476% (CAD $665.49). In medical supplies alone, OR hardware increased fees by 72% (CAD $117.47 versus CAD $68.43).[1] This cost-effective strategy was also observed in other centers. In a tertiary care facility in Calgary, Alberta, the overall cost of OR metacarpal fixations (CAD $2226) was approximately ten times the expenditure of those completed in minor surgery (CAD $250).[12] The same observations have been made with other types of procedures done under WALANT, such as trigger finger releases.[7]

In addition to institutional reduction of cost, when completed in an ambulatory setting, overall efficiency is enhanced by sparing time in the preoperative and postoperative phases.[2,3] However, surgical time from opening to closure remains unchanged; only the perioperative processing of patients and turnover are downsized.[5] Furthermore, patients benefit economically from expeditive management of hand fractures. By opting for an outpatient clinical setting, less travel and time off from work is imposed on patients given the reduced number of hospital visits required before surgery.[1]

Despite clear benefits of operating in an ambulatory setting, the majority of CRPPs continue to be performed in the OR throughout Canada. In a 2017 survey conducted by Gillis et al[1] addressing active members of the Canadian Society of Plastic Surgery, 59% of participants attested that 100% of CRPPs were completed in the OR. Around 48% of plastic surgeons reported never using exclusively local anesthesia for this procedure. Only 50% of participants reported having access to fluoroscopy in an ambulatory setting. Additionally, more than one-third of participants reported a lack of access to an ambulatory setting.[1] As few centers carry out the majority of their CRPP cases in outpatient clinics, we believe this study adds significant weight to the current literature encouraging centers to invest in a mini C-arm to perform these procedures outside the main OR. Considering the cost savings identified in this study and the amount of cases we performed, the cost of a CAD $100,000 mini C-arm can be reimbursed during a 2-year period.

This study is not without limitations. As it is a retrospective study design based on the experience of a single institution in the province of Quebec, our patient population was small and may not be an accurate representation of the cost discrepancies among different centers. From a provincial

standpoint, a multi-institutional cost analysis could offer a more accurate representation. We must also consider limitations related to the context and logistics of the clinical setting. In an outpatient clinic, procedures are not normally timed. We therefore used one hour as a mean reference number in our study's calculations. Although only a few complex cases (such as wound and tendon repairs or multiple digit fractures) were included in this study, we believe surgery time may have been underestimated because additional time required for these interventions was not factored. As such, our results most likely underestimate the actual monetary savings from the use of WALANT in percutaneous pinning of hand fractures. We further recognize that using an outpatient setting might not be achievable in every center. Spatial limitations or lack of fluoroscopy in certain clinics may prohibit the use of this model.

Our study, moreover, did not include clinical outcomes, patient satisfaction, or complications. A study following up on our complications is underway, but preliminary results do not demonstrate higher infectious rates when the procedure is performed in our outpatient clinic. A study of outcomes and complication rates as well as the inclusion of validated patient satisfaction outcome measures with this method could provide further insight into the use of WALANT for CRPP.

CONCLUSIONS

Outpatient percutaneous pinning of hand fractures resulted in a cost reduction of more than $55,000 CAD in a single year for a single center. These savings may further justify the addition of a mini C-arm in all Quebec plastic surgery clinics. Considering the numerous advantages of operating in an outpatient setting, it is clear that investing in ambulatory care setup for hand fracture treatment is largely beneficial. We therefore hope to encourage hand surgery departments in other centers to perform percutaneous pinning of hand fractures outside the main OR, and further entice government authorities to financially contribute to the implementation of these changes.

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DISCLOSURE

The authors have no financial interest to declare in relation to the content of this article.

DECLARATION OF HELSINKI

This study adheres to the Declaration of Helsinki.

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