





The 1 Year Effect of COVID-19 on Plastic Surgery Trauma at a Level One Trauma Centre: A Retrospective Review

L'effet d'un an de COVID-19 sur les chirurgies plastiques consécutives à un traumatisme dans un centre de traumatologie de niveau un : une analyse rétrospective



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Abstract

Introduction: Since the onset of the COVID-19 pandemic, Canada has seen significant societal and health changes leading to the closures of many businesses and shifts in the daily activities of many Canadians. Despite these changes and a sharp drop in the number of patients attending emergency departments across British Columbia (BC), little change was noted in the use of protected plastic surgery trauma time at a level one trauma centre surveyed in BC. The purpose of this study was to analyze and compare the changes in plastic surgery-related trauma cases before and after the onset of the COVID-19 pandemic, both in etiology and case description. **Methods:** A retrospective medical chart review was performed, evaluating all of the participating surgeon's trauma slates in the year before and after April 1, 2020. Patient demographics, etiology, injury location, diagnosis, and surgical timing were all recorded and analyzed using an interrupted time-series statistical model. **Results:** No significant difference was observed in any of the recorded categories across the 2 time periods. Slight increases were noted in workplace injuries, assaults, and home-related machinery injuries. **Conclusion:** The lack of significant change in workplace injuries likely stemmed from the high number of factories and industrial plants present in our health region, as these jobs lacked the ability to work from home. The results of this study show that the demand for trauma-related plastic surgery care is independent of an overall decrease in hospital admissions and therefore should be planned and budgeted for accordingly.

Résumé

Introduction: Depuis le début de la pandémie de COVID-19, le Canada a vécu des changements sociétaux et sanitaires importants qui ont entraîné la fermeture de nombreuses entreprises et des modifications aux activités quotidiennes de nombreux Canadiens. Malgré ces changements et une baisse marquée du nombre de patients qui ont consulté à l'urgence en Colombie-Britannique, le temps protégé pour les chirurgies plastiques consécutives à un traumatisme à un centre de traumatisme de niveau un sondé dans la province a peu changé. La présente étude visait à analyser et à comparer les modifications aux cas de

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traumatismes entraînant des chirurgies plastiques avant et après le début de la pandémie de COVID-19, tant pour ce qui est de l'étiologie que de la description des cas. **Méthodologie:** Les chercheurs ont effectué une analyse rétrospective des dossiers médicaux et évalué toutes les listes de réparation de traumatismes par les chirurgiens participants dans l'année précédant et suivant le 1^{er} avril 2020. Ils ont relevé les caractéristiques démographiques des patients, l'étiologie, l'emplacement de la blessure, le diagnostic et la durée de l'opération et les ont analysés au moyen d'un modèle statistique de séries chronologiques interrompues. **Résultats:** Les chercheurs n'ont observé aucune différence importante dans l'une ou l'autre des catégories enregistrées pendant les deux périodes. Ils ont remarqué de légères augmentations des blessures en milieu de travail, des agressions et des blessures causées par de la machinerie à domicile. **Conclusion:** Le peu de changements importants aux blessures en milieu de travail est probablement attribuable au grand nombre d'usines et d'installations industrielles présentes dans la région sociosanitaire, où il était impossible de travailler à distance. Les résultats de cette étude démontrent que la baisse globale des hospitalisations n'a pas d'incidence sur les besoins en chirurgie plastique découlant de traumatismes, qui doivent donc être planifiés et budgétés en conséquence.

Keywords

COVID-19, plastic surgery trauma, pandemic, trauma, resource, resource allocation

Introduction

Like most of the world,¹ Canada has experienced significant health and societal changes because of COVID-19.² Closures of businesses, changes in recreational opportunities and travel restrictions have contributed to a significant alteration in day-to-day activities.

British Columbia (BC) underwent a rapid response to COVID-19 after suffering the first death in Canada linked to the illness.^{3,4} Health orders issued in March of 2020 caused businesses such as restaurants to initially close before reopening under significant constraints. Nightclubs and dance halls remained fully closed for a longer period, and organized sports were strictly cut back. In addition, elective surgeries were reduced, and a travel ban went into place.

The health orders issued by the province and their resulting societal changes caused a sharp drop in the number of patients attending emergency departments in BC.^{5,6} This was not a unique phenomenon as many papers from other regions reported similar findings.⁷⁻⁹

According to the American Trauma Society, Plastic Surgery is a core service at all level one trauma centres.¹⁰ Common trauma cases involving plastic surgery in Canada include burns, microsurgery, facial trauma, hand trauma, as well as complex wounds and necrotizing fasciitis. A large proportion of these injuries arise from motor vehicle accidents (MVA), altercations, sports activities, and the use of heavy machinery both at home and in the workplace.^{11,12}

However, despite the significant changes to society because of COVID-19 restrictions, there was no perceived change in the utilization of protected plastic surgery trauma time at our regional level one trauma centre.

Many studies relating to the effect of COVID-19 on the health care system focused on the initial complete regional lockdowns and not on the longer-term effect of ongoing reductions in societal activity. Our study set out to determine if there was a change in the etiology of trauma being seen by plastic surgery during this period, or if there was a change in the case type (eg, oncology and complexity of trauma) that was filling this time.

Methods

We performed a retrospective medical chart review on all patients undergoing emergent and urgent procedures performed by 6 of the 11 plastic surgeons at the level one trauma centre.

Our level one trauma centre is part of a network of hospitals, which includes the second-largest emergency department in Canada, which is covered by 1 group of plastic surgeons.¹³ Most cases are transferred from the other hospitals within this network to the level one centre for care.

Under our public health system, the group is allocated 19 hours per week of scheduled trauma time to manage those injuries that can safely wait for treatment. All cases deemed more urgent are taken to the Operating Room (OR) as clinically indicated. This protected trauma time is also utilized in some cases for urgent oncology cases and the management of postsurgical complications.

We chose April 1, 2020, as the date full COVID-19 restrictions went into effect in our region. This date was chosen as it coincided with the end of spring break in most BC school districts. In addition, all elective surgery was cancelled after March 28 (a Saturday) which started to effect normal OR utilization on March 30. Due to the rolling nature of restrictions being implemented, April 1 was chosen as the clear date when all restrictions were firmly in place.

Our electronic medical record was searched for all codes related to all trauma slates and after-hour surgeries for the year prior to and the year following April 1, 2020. Patient files were then reviewed for the collection of pertinent demographic and treatment data.

Treatment data included primary diagnosis, secondary diagnosis if present, etiology, location of the injurious incident if applicable, the time of day of the surgery, and the procedure(s) performed.

We divided etiology into physical trauma, infection, surgical, vascular, neoplastic, and other. Etiologically, "physical trauma" was defined as any injury requiring surgical intervention resulting from a blunt or penetrating force. "Infection" was defined as the surgical debridement of infected tissue. The "surgical" category referred to surgical intervention to

address postoperative complications. The “neoplastic” category involved the surgical removal of malignant neoplasms. “Vascular” referred to surgical intervention to address the primary and secondary effects of vasculopathy. The category “other” refers to cases in which surgery was required to address the secondary consequences of disease, congenital conditions, and quadriplegia. Patients were then classified as pre-pandemic (April 1, 2019, to March 31, 2020) and postpandemic (April 1, 2020, to March 31, 2021).

Nontrauma cases were identified to show overall utilization of protected time and to determine if an increase in these cases made up for a reduction in trauma cases in the protected room.

Data were stratified into pre- and postpandemic periods and descriptive statistics (mean and standard deviation for continuous and counts for categorical) were used to describe the study populations.

To evaluate the possible immediate change in surgeries during the pandemic and any change in the temporal trend between periods we used an interrupted time-series (ITS) model. ITS is a quasi-experimental design to measure the effect of a change in time series, which is independent of the study population. For these analyses, we fit a Poisson model to daily surgery counts, which included a term for study time, an indicator for pre- and postpandemic and an interaction between these terms. Results are summarized as incidence rate ratios for the immediate change, and the subsequent temporal change in surgery count. Results are presented with corresponding 95% confidence intervals. Results are also displayed graphically.

Results

General demographic activity for both the prepandemic ($n = 379$) and postpandemic ($n = 489$) periods are summarized in Table 1. The mean age for the prepandemic (45.1 ± 20.7) and postpandemic (46.9 ± 20.0) cohorts show no meaningful statistical difference, as well as the sex distribution, being approximately the same (>36% female).

The distribution of surgical timing was maintained as well, as no significant difference was present amongst the operations taking place during normal operating hours, evenings, nights, and after hours.

Table 2 outlines the total and relative distribution of etiologies in both cohorts. Notably, despite the societal changes between the pre- and postpandemic groups, physical trauma

Table 1. Demographic data for pre and postpandemic groups.

	Prepandemic ($n = 379$)	Postpandemic ($n = 489$)	<i>P</i> ratio
Age (mean \pm SD)	45.1 \pm 20.7	46.9 \pm 20.0	0.183
Sex			
Female, n (%)	137 (36.1%)	187 (38.2%)	—
Male, n (%)	242 (63.9%)	302 (61.9%)	0.528

cases had approximately the same representation in prepandemic (73.9%) and postpandemic (73.6%) groups. Within the physical trauma category still no significant differences were found (Table 3).

Comparing the diagnostics between cohorts reveals similar results, as across multiple categories no difference in incidence proportion was found. Table 4 shows the adjusted p -value measuring the immediate change due to COVID-19. This adjustment for age, sex, and etiology continues to show no significant change between groups.

When comparing the total number of operations performed and the daily concentration of operations performed no difference between pre and postpandemic is seen (Figure 1). In fact, in the postpandemic period, a greater total number of operations were performed despite the societal changes seen during the COVID-19 pandemic.

Discussion

The results of our study indicate no significant change in the type or volume of cases because of COVID-19 health orders at our level one trauma centre, despite a reduction in overall emergency room (ER) visits.⁵ This likely has a multivariant reason.

Early in the pandemic, there was a significant emphasis placed on determining which surgeries should be allowed to proceed and what precautions would be required.^{14–17}

Table 2. Injury and surgical descriptors from both pre and postpandemic groups.

	Prepandemic ($n = 379$)	Postpandemic ($n = 489$)
<i>Injurious location</i>		
Home (%)	242 (63.9%)	318 (65.0%)
Work (%)	42 (11.1%)	52 (10.6%)
n/a (%)	95 (25.1%)	119 (24.3%)
<i>Surgical timing</i>		
Normal operating hours (need definition) (%)	333 (87.9%)	445 (91.0%)
Evenings (%)	18 (4.75%)	25 (5.11%)
Nights (%)	3 (0.79%)	2 (0.41%)
Weekends & Stat holidays (%)	25 (6.60%)	17 (3.48%)
<i>Schedule</i>		
Scheduled (%)	322 (85.0%)	428 (87.5%)
Afterhours urgent care (%)	57 (15.0%)	61 (12.5%)
<i>Etiology</i>		
Physical trauma (%)	280 (73.9%)	360 (73.6%)
Infection (%)	23 (6.07%)	23 (4.70%)
Neoplastic (%)	35 (9.23%)	51 (10.4%)
Surgical (%)	30 (7.92%)	36 (7.36%)
Vascular (%)	7 (1.85%)	16 (3.27%)
Other ^a (%)	4 (1.06%)	3 (0.61%)

^aConsists of etiology that fail to fit the major categories (quadriplegia & congenital disease-related etiology).

Table 3. Subcategories of physical trauma cases recorded.

	Prepandemic	Postpandemic
Physical trauma total	280	360
Motor vehicle incidents (%)	19 (6.8%)	21 (5.8%)
Kitchen incidents (%)	38 (13.6%)	21 (5.8%)
Altercations (%)	43 (15.4%)	39 (10.8%)
Sports (%)	43 (15.4%)	42 (11.7%)
Power tool usage (%)	33 (11.8%)	51 (14.2%)
Fall (%)	44 (15.7%)	55 (15.3%)
Drug use (%)	6 (2.1%)	3 (0.8%)

Table 4. Rate ratios from the Poisson model showing prepandemic, immediate change, and postpandemic-trend.

Parameter	Unadjusted		Adjusted ^a	
	Rate ratio (95% confidence interval)	P-value	Rate ratio (95% confidence interval)	P-value
Pre-COVID monthly trend	1.00 (0.99, 1.00)	.46	1.00 (0.99, 1.00)	.94
Immediate change due to COVID	1.03 (0)	.83	1.03 (0.79, 1.34)	.85
Post COVID monthly trend	1.00 (0.99, 1.00)	.81	1.00 (0.99, 1.00)	.97

^aAdjusted for age, sex, and etiology.

Trauma and malignancy cases were widely viewed as a high priority, meaning that they should continue despite the reduction in other surgical services.¹⁶ Initial concerns about reduced access to care for serious conditions were not typically realized, based on early studies.^{18,19} While there was a recognized delay in patients accessing trauma services in some cases, an overall decrease in time from injury to care was also noticed. An increased acceptance of telehealth consults might have been a mitigating factor in this pandemic. Telemedicine allowed for maintenance of patient access during this pandemic which may have allowed for fewer cases to remain untreated.²⁰ Unfortunately, recently published data from the United Kingdom shows an increase in non-COVID-19-related deaths in the past year versus those predicted for the same period.²¹

In BC, a significant reduction in elective resources was implemented at the beginning of the pandemic. Similar restrictions took place during the subsequent waves and at times of local spikes in cases and Intensive Care Unit admissions.³ These restrictions did not extend to emergency or oncologic surgery, explaining why our access to the OR was not curtailed for these procedures. We did not notice a significant decrease in the frequency of cases related to the treatment of malignancy or vascular wounds. This is likely related to the majority of these patients still receiving priority in outpatient clinics and the emergence of telehealth as a viable option in our health care system. The volume of infection-related cases, predominantly related to intravenous drug use, also did not change between the 2 study periods. We also did not notice a change in the age distribution of cases treated. It should be noted that all major trauma in our province though is triaged at the provincial

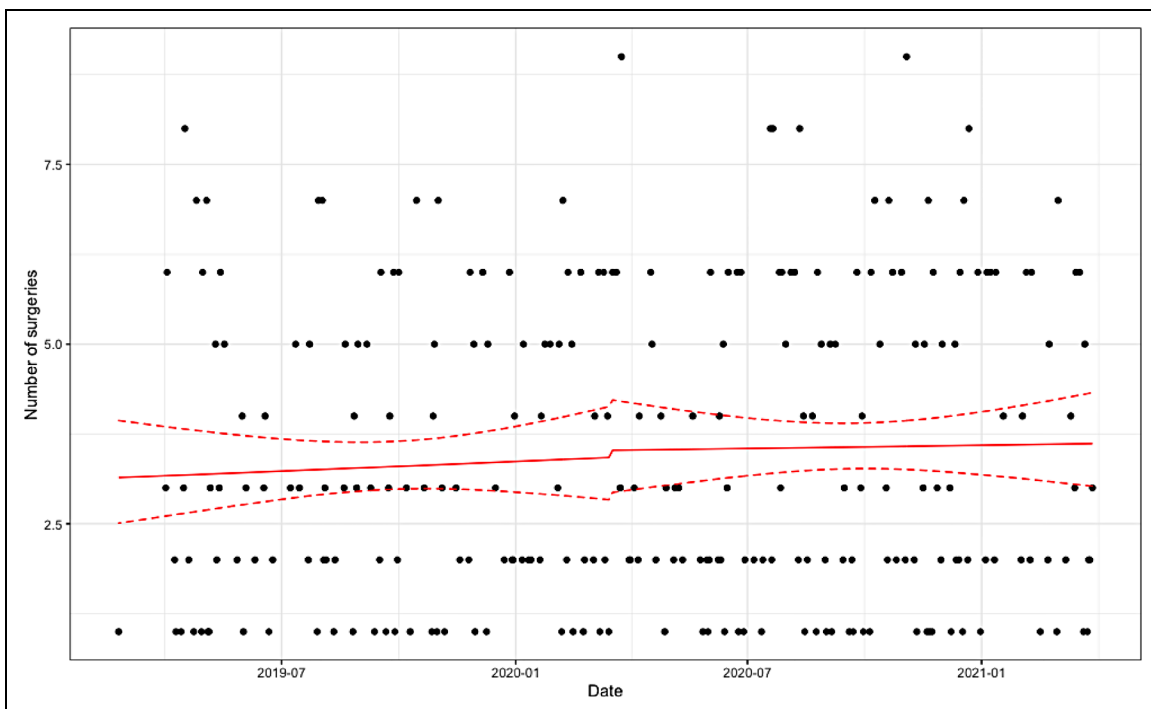


Figure 1. Daily concentration of surgeries pre and post April 1, 2020.

children's hospital and therefore a change in pediatric high-energy trauma would likely not be noticed at our centre. Even in the pediatric population, despite a drop in ER visits at major pediatric centres, an increase in minor injuries including bicycle and scooter falls were reported.^{22,23} More importantly, the study showed that there was no significant difference in the frequency by type of case (trauma, infection, oncologic, postoperative, and other). The health orders in place in the province affected all the typical causes of plastic surgery trauma and a drop in the proportion of urgent cases being trauma-related should have followed. Like many other jurisdictions, our province experienced a drop in ER visits.^{5,7,24} Admissions for serious illnesses were maintained at prepandemic levels in most studies^{7,9,24} and in some cases, an overall increase in hospital admissions was noticed.⁸ The reduction in ER presentations early in the pandemic can be attributed to fear of the contagion or perhaps also reflects misuse of the department prior to the pandemic. Oncology admissions remained stable during this period.¹⁹

The oncology cases treated during this time were cases that required surgical access and the allocated oncology slates were full. To prevent delay in their care, these cases would be added to the urgent care slate when time was available.

The next issue relates to the total number of cases treated. The total number of cases did increase, though not significantly. Our level one trauma centre is covered by a group of surgeons from 2 different offices. This study only reflects those patients treated by 1 of those 2 groups which make up 6 of the 11 surgeons in the larger group. The call is distributed evenly over a calendar year, but as this study overlaps years, the allocation of call days may have been skewed as a result. Regardless, the study indicates that there was no significant change in the number of patients treated in the COVID period versus the preceding 12 months. In fact, Figure 1 shows a very even and consistent distribution of cases, even in the immediate lockdown period.

The willingness of surgeons to take a patient to the OR should also be considered. Other studies showed a reduction in surgical interventions during the lockdown phase.^{18,23} While many surgeons in these other studies utilized nonoperative measures for select diagnoses, we did not examine the percentage of cases presenting in our clinic that received a more conservative management. However, given the trend in other studies to operate less, it is likely that if anything our group experienced the same bias, so the overall similar number of patients is likely a true number. Therefore, it can be concluded that plastic surgery at this level one trauma centre did not experience a change in total operative case volume.

Other studies did show an initial drop in trauma cases in the immediate lockdown period. Van Aert et al²⁵ studied trauma cases in the Netherlands during the first lockdown and noted a significant decrease in overall traumatic injuries, with sports-related injuries decreasing the most. Work-related injuries and falls increased significantly, however, in this period. It was also noticed that despite the reduced ER visits, the number of emergency surgeries went up.

Crenn et al²⁶ had similar findings over a longer period of time, with an increase in certain trauma presentations, including high severity traumas.

A reduction in low-energy injuries was common during the lockdown period in other studies.^{22,23} High-impact or penetrating injuries are more likely to require operative intervention than low-impact injuries. Therefore, a decrease in total referrals to plastic surgery, if present, might not have been reflected in a reduction in the number requiring surgical intervention. An increase in work-related injuries was seen, both in the number and types of injuries.²⁷ Our health region has a high number of industrial plants and factories. As these occupations cannot be done remotely, it would follow that the number of work-related injuries in our centre did not change. Despite the drop in motor vehicle-related accidents in our province similar to that of other studies,²⁸⁻³⁰ we also did not notice a change in the ratio of surgical cases coming from such accidents. Cases requiring plastic surgery in MVA are likely linked to an increase in speed, and a reduced number of vehicles on the road would afford a greater opportunity to speed. We do not have data on the number of high-impact MVA versus low-impact MVA, and this would be worthwhile examining to better isolate the cause of MVA-related plastic surgery injuries.

It would also appear that while there was an overall reduction in orthopedic trauma in most studies,³¹ there was a relative increase in the number of upper extremity injuries.

When upper extremity trauma was examined, it was noted that the ratio of upper to lower extremity cases went up significantly during the pandemic restriction period.³² This was true for both hand and wrist and total upper extremity cases. This reflected an increase in new hobby uptake and domestic abuse during this period. Changes in trauma etiology patterns were also seen in a number of studies, with an increase in soft tissue injuries, home machinery use, infections, and domestic injuries.^{33,34} Interestingly, we saw an increase in home-related machinery injuries, though this did not gain significance in our study, even when adjusted for age, sex, and etiology (Table 4). An Australian study reviewed hand-related injuries and noticed an increase in mean patient age-related to the increase in do-it-yourself activities.²⁷ A group in London, England showed that 31% of trauma-related injuries were due to new activities taken up during the lockdown period.³⁵ As our study showed no overall change in trauma-related surgery despite the significant societal change, it would seem that people will find a way to hurt themselves.

Unfortunately, an increase in domestic assaults was seen in many studies.^{27,29,35,36} Our data collection classified injuries as assault based, but not the exact type of assault. A reduction in physical altercations that one might predict from the closing of nightclubs and bars might have been replaced by domestic assault cases. Further studies would need to be conducted to examine this.

There were several limitations in this study. The first is around possible selection bias with patients of only 6 of the 11 surgeons at this site being reviewed. However, patients

from any one surgeon's call period will be placed on the next available trauma slate. As a result, we believe that bias would not be a significant limitation as to the decision to treat patients was made by all the surgeons in the group.

Next is the selection of April 1st being the date to make as the beginning of pandemic-related changes for the purpose of our study. The pandemic social restrictions came in a stutter-step fashion in BC, mixed in with federal mandates. ORs were closed to elective cases on March 25. A federal mandate for self-isolation came into effect on March 25. As a result, we picked a date that had all injuries treated having occurred after March 25. The first surgical date with no injuries prior to March 25 took place on April 1.

In addition, the sample size for certain groups was small, not allowing for specific conclusions about more specific types of traumas. As a result, the power of the study to identify a real change in these smaller groups is insufficient. A larger patient review from multiple centres would be required to determine the restriction effects on more narrowly focused categories.

Lastly, our study did not look at the total number of referrals to plastic surgery during this period, nor the number of nonoperative cases seen. While this might show overall demand for plastic surgery consultation and assistance, it was not a focus of this study.

Conclusion

In our study, we looked at a longer period related to COVID restrictions, not just the initial period where everything closed, and people were told to shelter in place. By including the entire year after the initial lockdowns, we were able to assess the effect of a changed social order on plastic surgery trauma. Despite various degrees of lockdown, travel restrictions, workplace changes, and activities, we did not notice a change in the total number of cases requiring plastic surgery intervention. This indicates that the demand for this care does not change despite overall decreased hospital admissions and that this needs to be factored into resource planning during pandemic-related changes.

Authors' Note

The project is a qualitative review which meets our ethics standards without specific board approval. The paper follows all ethical guidelines for the Fraser Health Authority. All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008.



Declaration of Conflicting Interests

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