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ABSTRACT

Background: The COVID-19 pandemic has caused a great impact on orthopedic surgery with a significant curtailment in elective surgeries which is the major bread and butter for orthopedic surgeons. It was also observed that the spectrum of orthopedic trauma injuries has shifted from more severe and frequent road traffic accidents (high energy trauma) to general, low energy house-hold injuries like low energy fractures in the elderly, pediatric fractures, house-hold sharp cut injuries and nail bed lacerations. The aim of this study is to appraise the effect of the COVID-19 pandemic on orthopedic surgical practice, both inpatient and outpatient facility.

Materials and methods: This is a retrospective cross sectional study conducted in a tertiary care teaching hospital. We collected data of patients admitted from February 1, 2020 to 30th April 2020 in the orthopedic service line using non-probability consecutive sampling. This study population was divided into pre-COVID and COVID eras (6 weeks each). The data included patient demographic parameters like age, gender and site of injury, mechanism of injury, diagnosis and procedure performed and carrying out of COVID-19 Polymerase Chain Reaction (PCR) test in the COVID-era.

Results: We observed that outpatient clinical volume decreased by 75% in COVID era. Fifty percent of surgical procedures decreased in COVID era as compared to pre-COVID era. Trauma procedures reduced by 40% in COVID era. Most common mechanism of injury was household injuries like low energy falls. A significant reduction in elective surgeries by 67% was observed in the COVID era.

Conclusion: The impact of COVID-19 pandemic has significantly changed the spectrum of orthopedic injury. More household injuries have occurred and are anticipated due to the ongoing effects of lockdown.

1. Introduction

Since the initial spread of novel coronavirus from Wuhan, China, the world’s dynamics have changed in almost every sector of life. Despite desperate containment measures taken by China the virus has spread in 210 Countries and Territories around the world. The World Health Organization (WHO) declared Covid-19 as a pandemic on March 11, 2020 [1,2].

Pakistan reported its first case on 26th February 2020 in Karachi [3] -the patient had travelled back from Iran; this case was diagnosed at our institution. Since then the tally has risen to 160,118 cases and 3093 deaths as of today, June 18, 2020 [4]. Steps had been taken pre-emptively by the government and enforced across the country via law enforcement agencies (military, police and paramilitary staff) in accordance with federal and provincial laws and regulations to restrict the spread of the virus. A complete lockdown was put in order on 15th March 2020, with closure of all businesses with exception of essential services, like grocery shops and the healthcare sector. All means of

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public transport, as well as inter-city and international travel were restricted. Information regarding precautions which included hand hygiene, use of facial masks, physical and social distancing was disseminated and reinforced repeatedly [5].

The COVID-19 pandemic has adversely impacted the entire world with the brunt to be borne even by third world and Lower-Middle Income Countries (LMICs). In Pakistan, it has negatively affected our struggling economy, industries, and private businesses and institutions. Hospital dynamics have seen an interesting dichotomy: on one hand the hospitals are overwhelmed with COVID-19 cases, while at the same time many private hospitals are struggling with a decrease in number of elective procedures and are therefore at a financial disadvantage. To ensure the availability of Personal Protective Equipment (PPE) and restrict spread of COVID-19, all elective surgeries were put on hold and only emergency and semi-urgent procedures were facilitated nationwide, and in our institute as well, from 16th March 2020 to 30th April 2020. Outpatient clinics and the orthopedic emergency bay were restricted to emergency issues such as infections, fractures, and follow-up care of post-operative patients. The screening of these patients was done by clinical staff and consultants only (residents were excused from the clinics); the rest of the patients were managed via tele-clinics which is a promising evolving modality [6–8]. All academic and administrative meetings were switched from physical to virtual ones.

It was also observed that the spectrum of orthopedic trauma injuries has shifted from more severe and frequent road traffic accidents (high energy trauma) to general, low energy house-hold injuries like low energy fractures in the elderly, pediatric fractures, house-hold sharp cut injuries and nail bed lacerations. This in turn may be a consequence of the nation-wide lockdown, where the majority of the population was living indoors. We have also observed some fire arm gunshot injuries. This may implicate the impact that joblessness and the subsequent economic burden (precipitated by the lockdown) has had on people; such instances have taken place despite deployment of law enforcement personnel in the city. The aim of our study was to appraise the effect of the COVID-19 pandemic on orthopedic surgical practice, both inpatient and outpatient. In this article we describe change in spectrum of orthopedic trauma objectively and compare procedures performed before and during the Covid-19 pandemic using the hospital management system at our institution.

2. Materials and methods

This is a retrospective cross sectional study conducted in one of the best tertiary care teaching hospitals in the region after obtaining IRB approval from our hospital’s ethical review committee. Our work has been reported in lines with STROCSS criteria [9]. The research registry unique identifying number is researchregistry5558. We collected data of patients admitted from February 1, 2020 to 30th April 2020 in the musculoskeletal and sports medicine service line using non-probability consecutive sampling. This study population was divided into pre-COVID and COVID eras (6 weeks each) according to date of admission: from 1st February 2020 to 15th March 2020, and 16th March 2020 to 30th April 2020 respectively. Patients in the pre-COVID era were admitted through Orthopedic Emergency Bay and clinics before imposition of lockdown and all sorts of emergency and elective surgeries were performed, while patients in the COVID era were admitted when lockdown was enforced in the city. Data was obtained from operation theatre and admission logs using the hospital information management system. The data included patient demographic parameters like age, gender and site of injury, mechanism of injury, diagnosis and procedure performed and carrying out of COVID-19 Polymerase Chain Reaction (PCR) test in the COVID-era.

Diagnosis and procedures were categorized into 4 major categories: trauma, infections (arthroplasty, debridements, synovectomy etc.), tumors and elective surgeries (arthroplasty, sports related ligamentous procedures, removal of implants etc.). Trauma surgeries were further categorized into soft tissue procedures and fracture fixation. Trauma surgeries were also stratified according to the region involved and subdivisions as per site involved. Microsoft Excel and statistical package for social sciences (SPSS v24) was used for data entry and statistical analysis. Nominal and categorical variable like gender and type of procedure were recorded as frequency and percentages and analyzed via Chi-square test or Fischer Exact test. Discrete and continuous data like age and length of stay were expressed as means with standard deviation or median with inter-quartile ranges and analyzed using independent t-test. A p-value of ≤0.05 was considered as significant with the confidence interval kept at 95%.

3. Results

3.1. Descriptive characteristics of study participants

A total of 405 patients who were admitted were included in the study during three months period for both eras (Pre-COVID: 269 patients & COVID: 136 patients) representing the fact that 50% admissions were reduced due to lockdown in COVID-era. The mean age (±SD) of study participants was 42.9 (±21.4) years in Pre-COVID group and 37.6 (±23.5) in COVID group. The higher age in Pre-COVID era is due to elective surgical procedures in older age group, like total joint replacement. Males were predominant in both groups: 62.8% and 68.4% in pre-COVID and COVID era respectively (Table 1). Out of 136 patients in the COVID group, 40 patients (29.3%) had their SARS-CoV-2 (PCR) tests done and only 2 (5%) tested positive for COVID-19.

3.2. Change in spectrum of orthopedic injuries and surgical intervention

During the study duration of three months, 390 surgical procedures were performed out of 405 patients admitted to the musculoskeletal service line at our institution. Majority of the procedures performed during COVID era were associated with trauma (62.8%) while only 21.71% of the procedures were performed as semi-elective surgeries, which included tumors and removal of implants (as semi-elective procedure by certain patients) during lockdown. Table 2 shows the distribution of surgical procedures performed based on presenting diagnosis before and during COVID era. COVID-19 disrupted daily practices: elective orthopedic procedures like joint replacements, nerve and tendon transfer, reconstruction of sports related injuries and care delivery system of orthopedic surgery. The number of surgical procedures performed during COVID era (n = 129) were 50% less as compared to pre-COVID group (n = 261). This effect was observed in number of ways. First, the number of elective procedures was reduced significantly in COVID era: 28 as compared to 80 cases in pre-COVID period. Similarly, tumor procedures were reduced from 21 in pre-COVID group to 7 in the COVID group. Infection
related procedures were reduced almost 50% from 27 pre-COVID, to 13 in the COVID period. Surgical procedures related to trauma were reduced from 133 to 81 from pre-COVID to COVID era. Covid-19 also changed the spectrum of traumatic injuries in terms of the nature of injuries, age, gender, site and region of injury, mechanism of injuries, and number of cases (procedures performed).

Our study showed that presentation of road traffic accidents (RTA) decreased radically from 51.5% (Pre-COVID) to 24.7% (during COVID) while household injuries increased from 40.9% (Pre-COVID) to 64.2% (during COVID). Table 3 demonstrates the change in mechanism of orthopedic injuries from Pre-COVID to COVID era in relation to age.

We further segregated the trauma data into fractures and soft tissue injuries. We encountered 110 procedures of fracture fixation in Pre-COVID era (out of 261) as compared to 59 patients (out of 129) in COVID era. Lower limb fractures were fixed mainly 48.2% in Pre-COVID and 45% in COVID era.). Most common lower limb procedures among adults involved fixations for proximal femur fractures including neck of femur and per-trochanteric fractures in both eras. No significant difference was observed between the two groups (p = 0.176).

Among the upper limb fractures in adults, the major bulk was confined to mid-shaft humerus, supracondylar and distal radius fractures. In COVID era low energy distal radius fractures topped the group (43%) while mid-shaft and distal humerus fractures involving a younger population was the most common injury (35.6%). Most of the fractures in the pediatric population (<16 years) were supracondylar fractures (Table 4).

We observed a significant change in spectrum of soft tissue injury (p = 0.045). Nail bed lacerations and clean sharp lacerations increased from 19% in the pre-COVID to 43% in the COVID era. Moreover clean and acute tendon and nerve injuries requiring repair also increased approximately 4 times in COVID era as compared to the pre-COVID era. However requirement of wound debridement for dirty wounds decreased by almost 32% in the COVID era. One patient required fingertip flap after auto-amputation of finger in the COVID era as compared to 2 patients who required flap coverage procedures for the same in pre-COVID era (Table 5).

### 4. Discussion

The burden of orthopedic trauma in Pakistan is already high due to few and far between tertiary health care centers and state of art facilities throughout the country. Tertiary care centers are available in major cities of Pakistan like Karachi in the south and Lahore in the center. Neglected, missed and mismanaged orthopedic injuries add to this burden. The current pandemic has aggravated the already compromised situation leading to further delay in optimal management. Most of orthopedic procedures involving use of power tools like drills, reaming and saw generate lots of aerosol particles, that can be a potential source of spreading infection, however there is no direct evidence to date regarding presence of viral particles in bone and bone marrow. Pulse lavage is commonly used in multiple orthopedic procedures. Pathogens surviving in these droplets of <5 micron suspended in the air can be a source of acquiring COVID-19 infection for orthopedic surgeons and

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**Table 3**

Mechanism of injuries from Pre-COVID to COVID era in relation to age.

| S# | Age Group     | Mechanism of Injury              | Pre-COVID Era N = 132 n (%) | COVID Era N = 82 n (%) | p-value |
|----|---------------|----------------------------------|----------------------------|------------------------|---------|
|    |               | RTA                              | 9 (50.0)                   | 4 (21.1)               | 0.242   |
|    |               | Machine/industrial injuries      | 1 (5.6)                    | 1 (5.3)                |         |
|    |               | Household injuries               | 6 (33.3)                   | 13 (68.4)              |         |
|    |               | Pathological fracture            | 1 (5.6)                    | 0 (0.0)                |         |
|    |               | Miscellaneous (gunshots and assaults) | 1 (5.6)                  | 1 (5.3)                |         |
| 3  | 17-50 Years   | RTA                              | 36 (63.2)                  | 11 (32.4)              | 0.41    |
|    |               | Machine/industrial injuries      | 2 (3.5)                    | 3 (8.8)                |         |
|    |               | Household injuries               | 16 (28.1)                  | 17 (50.0)              |         |
|    |               | Pathological fracture            | 0 (0)                      | 0 (0)                  |         |
|    |               | Miscellaneous (gunshots and assaults) | 3 (5.3)                  | 3 (8.8)                |         |
|    | >50 years     | RTA                              | 23 (40.4)                  | 5 (17.9)               | 0.117   |
|    |               | Machine/industrial injuries      | 11 (1.8)                   | 2 (0.0)                |         |
|    |               | Household injuries               | 32 (56.1)                  | 22 (78.6)              |         |
|    |               | Pathological fracture            | 1 (1.8)                    | 0 (0)                  |         |
|    |               | Miscellaneous (gunshots and assaults) | 0 (0.0)                  | 1 (3.6)                |         |
| 4  | Total         | RTA                              | 68 (51.5)                  | 20 (24.7)              | 0.02    |
|    |               | Machine/industrial injuries      | 4 [3]                      | 4 (4.9)                |         |
|    |               | Household injuries               | 54 (40.9)                  | 52 (64.2)              |         |
|    |               | Pathological fracture            | 2 (1.5)                    | 0 (0)                  |         |
|    |               | Miscellaneous (gunshots and assaults) | 4 (3.0)                  | 5 (6.2)                |         |
and nerve decompression procedures for carpal tunnel syndrome and outpatient clinic volume for orthopedic service was reduced significantly. This also led to a 70% reduction in the number of road traffic accidents in the COVID era (Pre-COVID era n = 81). This change in admissions was due to the fact that the outpatient facility was restricted to semi-elective and urgent issues like infections, fractures and tumors. Moreover the fear of contracting the COVID-19 virus dissuaded patients from coming to the hospital. In a cross-sectional study conducted in Hong Kong, Wong et al. [13] reported a 49.2% reduction in outpatient clinic volume among 122 outpatient facilities.

In our study we observed a significant reduction in the total hospital volume, both outpatient and inpatient facility in the COVID era. Our outpatient clinic volume for orthopedic service was reduced significantly from 3834 in pre-COVID era to 994 in COVID era (almost 25% of that in the Pre-COVID era). This volume included initial, follow-ups, and tele-clinic consultations. The number of orthopedic admissions reduced by approximately 50% (Pre-COVID era N = 269 and COVID era N = 136) with a significant reduction of admissions from the clinic and an increase in admissions from the emergency department (p = 0.026). This change in admissions was due to the fact that the outpatient facility was restricted to semi-elective and urgent issues like infections, fractures and tumors. The impact of COVID-19 pandemic has significantly changed the way forward is to strike a balance: the imposition of what is being called “smart lockdown”, completes with the avoiding of non-essential gatherings, maintaining social distancing, frequent hand washing and stringent use of face masks – all this with the concurrent opening of business, industries, and hospitals for elective work. We are unsure when the chaos and uncertainty will end, or if the world will be the same again – but the damage can be mitigated if we use rationale decision making based on strong scientific evidence.

5. Conclusion

The authors share no conflict of interest with respect to this manuscript.
Appendix A. Supplementary data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.amsu.2020.11.044.

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