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Article

"Lessons to Be Learned After the Storm"- Characteristics and Management of Dental Emergency Patients during COVID-19 Outbreak in Riyadh - A Retrospective Study

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Abstract: Background/Objectives: During the initial days in the COVID -19 pandemic, there existed no hospital-based policy or guidelines for management of dental emergency patients. The phase was marred with indecision and anxiety in general for dental patients and doctors as oral cavity along with saliva and indirect contact served as a harbor of transmission for the virus. **Methods**: The present study is retrospective, cross-sectional and descriptive in nature; the data was retrieved from the patients seeking emergency dental services during the COVID -19 lockdown (23rd of March 2020 to 23rd of April 2020) in primary and tertiary public hospitals of the National Guard Health Affairs in Riyadh, Saudi Arabia. **Results**: A total of 151 dental patients attended the outpatient/emergency during this period, The mean age of patients in the study was 31.4 (±19.0) years. Compared to Physicians, General dentist [OR 0.56, CI 0.29-10.47] were similar in giving an inappropriate diagnosis and treatment, whereas residents [OR 2.70, CI 1.65- 98.17] and resident endodontist [OR 2.30, CI 1.28-78.11] were more likely to give appropriate diagnosis and treatment. **Conclusions**: The findings from the study highlight the need for a greater number of endodontists to be at the forefront of screening and providing dental care during such health catastrophes.

Keywords: COVID-19, Dentistry, Oral Health, Endodontics, Antibiotics, Analgesics

1. Introduction

The world witnessed an alarming number of detrimental pneumonia cases in Wuhan, China in December 2019, initially the etiology of which remained unknown, timely intervention by epidemiologists and scientists helped understand the viral strain to be a novel Coronavirus 2 (SARS-CoV-2)/ severe acute respiratory syndrome -CoV-2 [1]. Initially the WHO stated the disease to be "Public Health Emergency of Internation Concern", As the virus strain spread across geographical borders the World Health Organization (WHO) declared it as a pandemic on March 11, 2020 [2].

The first case in Saudi Arabia was detected on March 2, 2020 [3]. Within three weeks, on March 23, 2020, partial lockdown was put in place as 562 cases were reported in the country. Eventually

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complete lockdown was implemented on April 6, 2020, since the number of reported, positive cases had increased to 20605, lockdown was imposed to curb the spread of infection, which was predominantly through the aerial route (aerosols/droplets) [4].

The lockdown consisted of several restrictions as per international protocols put in place by then. All institutions (academic, commercial, and cultural) discontinued functioning, except for medical care, which had emergency and outpatient wards open for attending to patients' health grievances [5]. This was apart from specialized flu clinics, which handled COVID-19 cases.

In line with most countries, elective dental treatments were halted and postponed in the region [6]. The management of the emergency dental cases switched to a less invasive and more of a screening type of approach minimizing procedures that involved the production of aerosols to avoid transmission of COVID-19 when compared to the management of these cases prior to the pandemic. There existed no guidelines prior to the pandemic on the approach and management of cases with dental emergency reporting to clinics in such wide-spread catastrophic natural calamities [4].

Ministry of Health (MOH), Saudi -Arabia issued guideline for management of dental emergency cases in the country in April 2020 [7]. American Dental Association (ADA) infection control protocol and patient management during the pandemic guidelines was published on 19th of May 2020 [8].

To our knowledge there have been no studies reported from this region enlisting the characteristics of dental patients and their subsequent management at outpatient/emergency of major hospitals during the recent pandemic, in the region of Saudi Arabia.

Hence the aim of the present was to assess all the characteristic variables and management of patients who reported to the dental outpatient/emergency department during the early phase of lockdown amidst COVID -19 pandemic.

2. Methods

The patient database (BEST care) was accessed for a specific purpose of emergency dental care visits during COVID-19 lockdown.

2.2. Data Collection:

The present study is retrospective, cross-sectional and descriptive in nature; the data was retrieved from patients seeking emergency dental services in tertiary public hospitals of the National Guard Health Affairs in Riyadh, Saudi Arabia. The data collected was limited to the lockdown period from March 23 to April 23, 2020. The data included demographic characteristics of the dentists and the patients. Independent variables such as number of patients, diagnosis, and type of procedures done were recorded. Collected data was transferred from the patient data platform (SALUD- State of the Art platform for data collection) to Microsoft Excel. Further data cleaning was carried out to standardize the inputs and coded, and data was eventually transferred to SPSS (Statistical Package for the Social Sciences) software (Version 20).

2.3. Exploratory Variables Recorded:

Data was collected at all the emergency care centers through a unified recording platform. The recording consisted of patient-based demographic inputs such as enrollment number, gender, date of birth, age of the patient, and patient reporting to the outpatient (OP)/ emergency room (ER). Ten other exploratory variables recorded were about the hospital records such as Reporting hospital, Type of diagnostic department, ICD 10 (CODE), Diagnosis, Attending Physician/ dentist (along with their specialty ranking), record form type, treatment received, patient symptom and X-ray/diagnostic aid suggestion.

2.4. Statistical Analysis:

The data was entered into Microsoft Excel and transferred to SPSS statistical software for analysis. Descriptive statistics were used to describe all the qualitative variables and demographic data. Pearson's chi-square analysis was used to find the significance of patient management between the specialties of physicians along with exploration variables. Those variables of significance were further analyzed with multinomial regression analysis.

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3. Results

A total of 151 patients' dental records were assessed through the common database adopted across various National Guard Health Affairs hospital centers. These records of dental patients reporting to these centers' emergency and outpatient departments were assessed during the complete lockdown, one month between March 23, 2020, and April 23, 2020.

The mean age of patients in the study was 31.4 (±19.0) years. The minimum and maximum age of reporting patients were observed to be 2 years and 76 years, respectively. Predominantly, 85 males (56.3%) reported at outpatient, compared to the 66 females (43.7%) during the period considered for observation. Most of the patients with oral health-related chief complaints during this period reported at emergency 81 (53.6%); a high number, 113 (74.8%) of these patients could be seen reporting at the Hospital of King Abdullah Medical City- Riyadh (KAMC-R), (Table 1).

Table 1. Demographics of the patients attending the dental outpatient.

	Demographic Variable	Total (N)	Mean	Standard Deviation (±)	Frequency (n)	Percentage (%)
	Age of Patients	151	31.4	19.0	-	-
Patient Type	Emergency (ER)	151	-	-	81	53.6
	Outpatient (OP)				70	46.4
Gender	Male	151	-	-	85	56.3
	Female				66	43.7
Hospital Visited	DIRAB (Area)	151	-	-	09	6.0
	ISKAN (Area)				13	8.6
	King Abdullah Medical City-Riyadh (KAMC-R)				113	74.8
	King Khalid Medical City (KKMC)				03	2.0
	Ministry of National Guard Clinics (MNGC)				02	1.3
	National Guard Comprehensive Specialized Clinics (NGCSC)				11	7.3
Symptoms	Pain	151	-	-	41	27.2
	Swelling				39	25.8
	Abscess				19	12.6
	Other Symptoms*				08	5.3
	No Data				44	29.1

* Other Symptoms- Fractured tooth (1), Chemotherapy Patient (1), Bleeding Gums (6).

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While pain (27.2%) and swelling (25.8%) were the most common symptoms to be reported by the patients, unfortunately no data was recorded under the symptom column for 44 (29.1%) of the patients. Resounding with the most common symptoms reported, the clinical diagnosis of peri-apical abscess (40.4%) and pulpitis (23.2%) were evident from the data. Antibiotics were mostly prescribed under the treatment to 59 (39.1%) of the patients (Table 2).

Table 2. Frequency and percentage representation of various diagnosis and treatment as observed from the data.

	Category	Total	Frequency	Percentage
Diagnosis	Peri-Apical abscess	151	61	40.4
	Dental Caries		34	22.5
	Gingivitis		14	9.3
	Oral ulcer		04	2.6
	Periodontitis		03	2.0
	Pulpitis		35	23.2
Treatment	Analgesic		04	2.6
	Antibiotic		59	39.1
	Extraction		09	6.0
	Endodontic Treatment		14	9.3
	Referred		07	4.6
	No Data		27	17.9
	No Treatment or Medication		20	13.2
	Other		11	7.3

*Significance= (P<0.05).

Fisher's exact test was adopted to determine if significance existed between variables in question. When symptoms were analyzed as against preoperative x-ray taken, most intra-oral periapical (IOPA) radiographs were taken when patient complained of pain 13 (8.6%), Orthopantomography (OPG) was considered in 3 (2.0%) cases of swelling. On the whole no radiographs were taken among 83 (55.0%) of the patients reporting, whereas 38 (25.2%) of the patients were recommended for pre-operative radiographs (P<0.00) (Table 3).

Similarly, significance (P<0.00) was observed with the fisher's exact test when treatment was assessed based on symptoms, majority of the patients were dismissed with medication, antibiotics being prescribed for 59 (39.1%) and analgesic for 4 (2.6%) patients respectively, together contributing to 63 (41.7%) patients being treated by medication only. Treatment was undertaken in a total of 39 (22.6%) patients, which consisted of 14 (9.3%) endodontic treatments, 9 (6.0%) extractions and about

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11 (7.3%) treatments consolidated under the other category (Oral hygiene procedures, mouth wash recommendations etc.). (Table 3).

Crosstabulation also analyzed the diagnosis based on specialty of the doctor at the frontline during the period, a significant (P<0.00) relation between the specialty of doctor and diagnosis was observed, periapical abscess and pulpitis were mostly diagnosed by physicians and dentists. (Table 3).

Table 3. Crosstabulation to assess the significance between independent (symptoms and diagnosis) variables and dependent variables (X-ray/Treatment/Specialist).

SYMPTOMS	**Pre-operative X-ray**							
	Yes	OPG	NO IOPA/OPG	Wrong MRN	No Information	Total	df	Fischer's exact test (Sig)
Pain	13 (8.6)	0 (0.0)	24 (15.9)	0 (0.0)	4 (2.6)	41 (27.2)	16	P=0.00*
Abscess	6 (4.0)	0 (0.0)	13 (8.6)	0 (0.0)	0 (0.0)	19 (12.6)		
Swelling	5 (3.3)	3 (2.0)	30 (19.9)	0 (0.0)	1 (0.7)	39 (25.8)		
No Data	11 (7.3)	0 (0.0)	12 (7.9)	4 (2.6)	17 (11.3)	44 (29.1)		
Other Symptoms	3 (2.0)	0 (0.0)	4 (2.6)	0 (0.0)	1 (0.7)	8 (5.3)		
Total	38 (25.2)	3 (2.0)	83 (55.0)	4 (2.6)	23 (15.2)	151 (100)		

SYMPTOMS	TREATMENT										
	Analgesic	Antibiotic	Extraction	Endodontic Treatment	Referred	No Information	No Treatment or Medication	Other	Total	df	
Pain	3 (2.0)	18 (11.9)	3 (2.0)	9 (6.0)	1 (0.7)	2 (1.3)	3 (2.0)	2 (1.3)	41 (27.2)	28	P=0.00*
Swelling	1 (0.7)	24 (15.9)	3 (2.0)	0 (0.0)	0 (0.0)	2 (1.3)	6 (4.0)	3 (2.0)	39 (25.8)		
Abscess	0 (0.0)	9 (6.0)	0 (0.0)	2 (1.3)	0 (0.0	1 0.7	5 3.3	2 1.3	19 12.6		
No Data	0 (0.0)	5 (3.3)	3 (2.0)	3 (2.0)	4 (2.6)	22 (14.6)	4 (2.6)	3 (2.0)	44 (29.1)		
Other Symptoms#	0 (0.0)	3 (2.0%)	0 (0.0)	0 (0.0)	2 (1.3)	0 (0.0	2 (1.3)	1 (0.7)	8 (5.3)		
Total	4	59	9	14	7	27	20	11	151		

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	(2.6)	(39.1)	(6.0)	(9.3)	(4.6)	(17.9)	(13.2)	(7.3)	(100)	
DIAGNOSIS	SPECIALITY									
	Dentist		Endodontist	Physician	Residents	Total		df	Fischer's exact test (Sig)	
Peri-apical Abscess	20 (13.2)		1 (0.7)	30 (19.9)	7 (4.6)	58 (38.4)		15	P=0.00*	
Dental Caries	13 (8.6)		4 (2.6)	11 (7.3)	7 (4.6)	35 (23.2)				
Gingivitis	7 (4.6)		0 (0.0)	6 (4.0)	0 (0.0)	13 (8.6)				
Pulpitis	11 (7.3)		0 (0.0)	23 (15.2)	3 (2.0)	37 (24.5)				
Chronic Apical Periodontitis	0 (0.0)		3 (2.0)	0 (0.0)	0 (0.0)	3 (2.0)				
Other	2 (1.3)		0 (0.0)	2 (1.3)	1 (0.7)	5 (3.3)				
Total	53 (35.1)		8 (5.3)	72 (47.7)	18 (11.9)	151 (100)				

*Significance= (P<0.05); Other Symptoms♯ Fractured tooth (1), Chemotherapy Patient (1), Bleeding Gums (6).

The final crosstabulation was carried out to analyze medication (analgesic/antibiotic) prescribed and endodontic treatment/ referral based on symptom with that of the specialty of doctor at the point of contact, there was a significant difference (P=0.01) observed especially with antibiotic prescription by physicians for pain and swelling compared to other specialists (Table 4).

Table 4. Medication and endodontic treatment/referral for symptoms (pain, swelling, and abscess) based on specialist at point of contact.

SYMPTOMS	**TREATMENT**	**Ranking/Specialty**				**Total**	**df**	**Fisher's exact test**
		Dentist	Endodontist	Physician	Residents			
Pain	Analgesic	1 (2.4)	0 (0)	1 (2.4)	1 (2.4)	3 (7.3)	15	0.01*
	Antibiotic	6 (14.6)	1 (2.4)	9 (22.0)	2 (4.9)	18 (43.9)		
	Endodontic Treatment/ Referral	4 (9.8)	2 (4.9)	2 (4.9)	1 (2.4)	9 (22.0)		
	Total	11 (26.4)	3 (7.2)	12 (28.8)	4 (9.6)	30 (72.0)		
Swelling	Analgesic	0 (0)	0 (0)	1 (2.6)	0 (0)	1 (2.6)		

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	Antibiotic	4 (10.3)	2 (5.1)	14 (35.9)	4 (10.3)	24 (61.5)
	Extraction	2 (5.1)	0 (0)	0 (0)	1 (2.6)	3 (7.7)
	Total	6 (28.8)	2 (5.1)	15 (39.0)	5 (13.0)	28 (72.8)
Abscess	Analgesic	1 (5.3)	NA	1 (25.0)	1 (25.0)	3 (75.0)
	Antibiotic	2 (10.5)	NA	6 (31.6)	1 (5.3)	9 (47.4)
	Endodontic Treatment /Referral	1 (5.3)	NA	0 (0)	1 (5.3)	2 (10.5)
	Total	3 (15.9)	NA	7 (37.1)	3 (15.9)	14 (74.3)

*Significance= (P<0.05).

Multinomial logistic regression analysis was carried out to analyze if there existed discrepancy in diagnosis and treatment between various specialty doctors, since majority of the cases had a pulpal involvement, board certified endodontist served as gold standard to dichotomize the diagnosis and treatment into appropriate and inappropriate based on pre- operative x-ray findings as well as the diagnosis and treatment considered by the specialty doctors.

The analysis revealed a significant difference in the way the various specialty doctors did diagnose and suggest/carry out treatment, Compared to Physicians, General dentist [OR 0.56, CI 0.29-10.47] were similar in giving an inappropriate diagnosis and treatment, whereas residents [OR 2.70, CI 1.65- 98.17] and resident endodontist [OR 2.30, CI 1.28- 78.11] were more likely to give appropriate diagnosis and treatment (Table 5).

Table 5. Multinomial regression to assess significance of significance of diagnosis and treatment based on speciality.

Variable	**Independent Variable**	**B**	**df**	**Sig.**	**Exp(B)**	**95% Confidence Interval for Exp(B)**	
						Lower Bound	Upper Bound
Endodontist Expert Opinion on Appropriate Diagnosis and Treatment	General Dentist	0.56	1	0.43	1.76	0.29	10.47
	Resident	2.70	1	0.01*	15.0	1.65	98.17
	Resident Endodontist	2.30	1	0.02*	10.0	1.28	78.11
	Physician	0#	-	-	-	-	-

#- Reference category, Last category was considered the reference, B- Odds, and *Significance= (P<0.05).

4. Discussion

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The study provides crucial data regarding the findings of dental care utilization patterns and the practitioner's availability at the point of care. It determines the type of diagnosis, treatment, and referral made by practitioners during the initial phase of the COVID-19 pandemic lockdown. This phase of the pandemic was marred by uncertainty for doctors in emergency and outpatient services who were on the frontlines of duty [9,10].

As most of the routine dental care was unavailable during the pandemic, patients were expected to seek emergency dental services when needed. Moreover, there are no previous guidelines on what would qualify to be an emergency dental care service [4]. This study reports findings from the onset of the COVID-19 lockdown in the country. Anxiety engrappled society during the phase; hence, the outpatients saw a drastic drop in patient flow. A similar finding was reported in China; the overall dental emergency patient count was reduced by 38% due to lockdown restrictions and fear of venturing out [11].

A high number of male patients reported at the dental emergency during the lockdown at the hospitals considered in the study, the finding is similar to other studies reported from the region by Olayan, A.A et.al., [12] and Yaqin Syed, A.U et.al., [13]. In the study, pain was the most common dental symptom reported by the patients in emergency, similar to studies by Sun, Q et.al., [14] and Moca, A.E et.al., [15] respectively.

One of the significant findings of this study was the presence of physicians at the point of care for dental emergencies, which does reflect on the low percentage of dental radiographs (IOPA/OPG) taken during this period. This may be attributed to the concerns of saliva contamination among the physicians, X-ray facilities integrated within open clinics, lack of radiology technicians, or unawareness of needing radiographs in specific dental emergencies. Studies do suggest radiology units have fewer chances of disease transmission, either through direct or indirect methods compared to other specialties in dentistry [16].

Moreover, the viral load of asymptomatic patients was similar to that of symptomatic patients, and about 20% to 60% of patients had minor nonspecific symptoms [17]. In such a scenario, it is difficult to delineate among patients who could be and could not be provided with dental services; hence, all patients are treated with a uniform policy.

International guidelines for dental practice during the pandemic came into existence only after knowing the nature of the virus; until then, there were no existing guidelines for dental practice in epidemic or pandemic situations. American Dental Association (ADA) mandated that all dental clinics stop functioning until April 30, 2020 [8]. The earliest guideline for infection control during COVID-19 in dental practice was given on May 19, 2020. Interestingly, a paper was published with guidelines for emergency dental care in Saudi Arabia early into the pandemic (by the first week of April 2020) [4]. The Ministry of Health (MOH) came up with the protocol for the treatment of dental patients only in the second week of April 2020 [7]. Subsequently (9 months after COVID-19), a study by Basheer SN et al. reflected upon low levels of knowledge in dental healthcare personnel about the COVID-19 protocol published by MOH [18].

In the present study, it is clear that the need for dental specialists at the frontline for screening, diagnosis, and treatment at emergency dental clinics, especially the role of endodontists, considering most dental symptoms and subsequent final diagnosis are related to odontogenic infections [19,20]. Our finding of a high percentage of people with periapical abscess and discharge of patients with antibiotics for pain is appalling. It corroborates with findings presented by the American Association of Endodontists (AAE) [21].

As per the systematic review conducted by Lockhart PB et.al., under the aegis of the American Dental Association Council and Center for Evidence-based Dentistry, formulated the clinical recommendations for emergency management of symptomatic irreversible pulpitis with or without peri-apical infection, which states there is no need for antibiotic prescription unless patients exhibit systemic involvement such as fever/malaise arising from dental infection. These recommendations were primarily aimed at general dentists and could be used by dental specialists, public health dentists, emergency and primary care physicians and policymakers. These recommendations can be deliberated upon and help with policy framework [22].

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The present study concludes that endodontist/ endodontic residents would play a highly significant role in appropriate diagnosis and treatment compared to physicians and general dentists. Chaudhary FA's systematic review on endodontic treatment during COVID-19 resonates with this conclusion [23].

5. Conclusions

COVID-19 has affected the world in many ways, as the last pandemic known to humankind was more than a century ago; the present study provides crucial insights into the regional preparedness to handle dental emergencies during the health catastrophe. The key takeaways from the present study suggest the need to train frontline physicians in essential dental diagnosis and referral along with appropriate medication guidelines, especially regarding antibiotic prescription for patients reporting dental pain, unless there is a systemic indication. There is a need for clear policy on dental radiography for better understanding of its minimal cross-contamination, among the physicians. The internal policy existent for the diagnosis and management of dental patients was analyzed, which is one of the main limitations of our study.

Endodontists and dental residents do play a key role in managing dental emergency patients and their posting and availability during pandemics or epidemics is crucial for appropriate care of dental patients.

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Informed Consent Statement: Patient consent was not required because this study is retrospective and uses secondary data (anonymized) retrieved from patients seeking emergency dental services in tertiary public hospitals of the National Guard Health Affairs in Riyadh, Saudi Arabia.

Data Availability Statement: Data available in publicly accessible repository. The data presented in the study are openly available in [Fig Share] at 10.6084/m9.figshare.28052555.

Conflicts of Interest: The authors declare no conflicts of interest.

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