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Lubna Ashraf Jafri
Aga Khan University, Karachi

Maryam Javed
Aga Khan University, Karachi

Ali Sajjad
Aga Khan University, Karachi

Dureshahwar Kanwar
Aga Khan University Karachi

Mohammad Wasay
Aga Khan University, Karachi

NEUROLOGICAL CARE AND TRAINING IN THE TIMES OF COVID-19: A TERTIARY CARE CENTER EXPERIENCE

Lubna Ashraf Jafri[1], Maryam Javed[2], Ali Sajjad[3], Dureshahwar Kanwar[4], Mohammad Wasay[5]
[1,2,3,4,5] Department of Medicine, Aga Khan University, Karachi, Pakistan.

Correspondence to: *Dr. Ali Sajjad,Department of Medicine, Aga Khan University Karachi Email: ali.ishtiaq@aku.edu*

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ABSTRACT:

Resilience in these challenging times of COVID-19 at a professional and personal level is cardinal. Trainees and faculty have had to adapt to this adversity with striking limitations on formal neurological, neurovascular and neurophysiological residencies and fellowships. The revision of schedules and reallocation of assignments to cope with the practical aspects in a teaching tertiary care hospital have been overbearing. Novel structural innovation, testing, communications and supervision to assure a modified yet impactful training educational programme is mandatory and the need of the hour. Healthcare service providers remain at the highest risk of acquiring COVID-19 worldwide. Urgent measures to educate them about personal protective equipment (PPE), disease course, infectivity and complications were initialized at the first impact of COVID-19. Foreseeing the pandemic in months to come, here we describe the elemental changes made at the Aga Khan University Hospital (AKUH) Karachi, Pakistan a leading academic institute in health sciences and one of the largest tertiary care hospitals in the country and all the modifications contrived in the section of neurology to deal with the brunt of the pandemic. The neurology section devised a strategy balancing clinical work, research and academic activities.Tele health clinics were encouraged and set up across all specialties to minimize in hospital encounters whilst answering concerns of patients and their caregivers. Collaborative efforts, nationally and globally are the requirement as we continue to learn through clinical experience, trials and research on all the potential complications of COVID-19 in these dismal times.

Keywords: Healthcare services, Tele health, Personal protective equipment (PPE)

INTRODUCTION:

THE IMPACT OF COVID-19:

The first case of the novel coronavirus, COVID-19, in Pakistan was diagnosed at AKUH Karachi on the 26th of February 2020 when a young, previously healthy man who had travelled to Pakistan from Iran a week back developed fever, headache and cough.[1] The proportion to which this number would escalate and the impact it would have on the general population and the health care system was unprecedented. As we are writing, Pakistan has already crossed dreaded mark of more than 250,000 diagnosed cases. Though the storm has receded, with less than 1000 cases being reported since 1st August 2020, the transforming effects on health care services appears far from over.[2] Probably the biggest concern COVID-19 brought to the healthcare was the uncertainty to deal with the disease at such a large scale. Past experience with SARS CoV-1 and MERS CoV along with improvised trial and error strategy was the only way to move forward. Initially international guidelines from WHO/CDC[3]/OSHA[4] (occupational safety and health administration) was followed and later national guidelines were incorporated as they became more established.[5] The safety environment the doctors needed to treat the COVID-19 suspected or confirmed patients became mandatory so did the prevention of cross contamination between healthy and infected patients which was no less than a huge challenge. Everyday norms like combined medical board meetings ,academic sessions, to sharing a meal with colleagues in the cafeteria all became impossible. The outpatient department suffered no less than in-patient service with disproportionate delay, cancellations or patient-less clinical appointments. Routine surgical

procedures requiring COVID-19 screening created another anxiety among attendants. Aside from rapidly increasing demand of dedicated COVID-19 health services area, prompt ICU accommodation and critical care became matter of utmost precedence. Such logistic issues required meticulous policy making and provident planning to deal with the pandemic in the short term and long term. The discussion aims to share the experience of the challenges faced in our institution by COVID-19 and radical measures taken to overcome them. The experience can be a beacon of guidance for other local institutions. All the health care institutions across the globe, in their own ways, transformed their services to withstand the impact of COVID-19 pandemic. One such exemplary institution was the Columbia University Irving Medical Center and the New York Presbyterian Hospital in New York City (NYC) that prepared itself for this massive hit. NYC and its suburbs have had over 5% of the global cases. Starting from mid-February multidisciplinary meetings held with key staff including nursing leadership, intensive care leadership, inpatient and outpatient neurology department leaders, and departmental administrative leadership to devise plan to train the employees for personal and patient safety measures, isolation policy and use of personal protective equipment (PPE). Given the restrictions for large in-person gatherings, they held webcasts weekly, to provide updates on inpatient and outpatient clinical care activities, departmental research ramp down, human resources issues, and updates on hospital and public health guidelines including key epidemiologic information around COVID-19.[6] This led to smooth and effective diffusion of essential information from policy makers to bedside working staff. AKUH, Karachi is an approximately 650 bedded tertiary care hospital, with frequent 100% occupancy rates in the pre-COVID-19 era due to being a heavily populated city and a central transportation hub. The COVID-19 pandemic brought an additional burden of patients requiring a unique way of handling in terms of isolation and safety precautions on nursing side to comprehensive knowledge of latest guidelines and meticulous critical care on the physician's part. With the initial surge in COVID-19 patients, the changes that occurred at every aspect here at AKUH and the contribution by each employee to deal with the dire situation have been tremendous and never seen before.

INITIAL BASIC MODIFICATIONS:

The Emergency department, AKUH is a 62 bedded facility. With an initial dedication of 4 ventilator beds and 8 isolation ward beds for COVID-19 patients. The capacity was later increased to 12 ventilator beds, 10 ward beds and 16 special care beds. The Emergency Room (ER) started screening every patient at triage and designated an entire resuscitation and monitoring area to COVID-19 patients. Anticipating inevitable flow of patients, a surge capacity protocol was initiated. A separate three storied building (former private wing),was converted to a COVID 19 unit comprising of 122 beds inclusive of an intensive care, high dependency units and wards for isolation and effective inter hospital transportation. A 10 bedded ventilator supported area nearby emergency was also devoted to COVID-19 patients .All remaining facilities and subspecialties beds were translocated to other areas in the multi building hospital. Healthcare providers remain at the highest risk of acquiring COVID-19 worldwide.[7] Starting from mid-February, urgent measures to educate all the employees about the disease course, infectivity and the precautions were taken proactively. All the members of various specialties in the hospital divided in small groups were given detailed instructions regarding use of Personal Protective Equipment (PPE), its donning and doffing, on a regular basis as per national guidelines by a panel comprising of experts from infectious diseases, infection control and patient/employee safety maintenance department.5 Through frequent audits and rounds with primary service teams, the nursing leadership and infectious control department kept a close watch and ensured that all precautions were being taken appropriately. Since N-95 mask fitting is mandatory, the fit testing was carried out by reagent testing for various subspecialties to give maximum protection against Covid-19. Workshops for technique of nasopharyngeal swab testing was carried out for interns, residents and senior staff members to assure proper sampling when required.

ELEMENTAL CHANGES IN NEUROLOGY SECTION:

Foreseeing the devastation in months to come the neurology section devised a strategy balancing clinical work, research and academic activities. By mid-March 2020, the classic schedule of separate neurology inpatient service (covering primary patients only) and consult service (covering periphery patients) were merged and a new on-call schedule was in place. The main focus was to call the minimum possible number of members in a given team on duty at one time. A balance had to be kept minimizing exposure of the doctors, nursing staff and other health workers to COVID-19 cases while keeping the current neurology work load in view. Averaging 20-25 admitted patients per day before the crisis, the workload of neurology

department declined to around 8-15 cases per day, as expectedly, more suspected patients went to COVID-19 isolation other than primary neurology services. The main focus had to be changed to Neurology consult service for COVID-19 patients with frequently seen neurological complications including meningoencephalitis, stroke, cerebral venous sinus thrombosis, Guillian-Barre syndrome and critical illness neuro-myopathy. One resident was also sent for a week fortnightly rotation to COVID-19 ICU with secondary aim to learn COVID-19 associated neurological manifestations in critically ill patients balancing with minimal adverse impact on basic neurology training and increasing man power in the overworked areas. Interdisciplinary online academic and clinical board meetings were arranged. In rare cases requiring virtual rounds, at least one primary team member would go to the bedside, examine the patient as per instructed by attending and perform procedures such as lumbar punctures, central lines, needle electromyography with minimal staff if required. More focus was given to brief relevant examination with high yield rather than detailed examination. Non infected patients were regularly examined as per standard timings every 6 to 8 hours during 24 hours. In case of COVID-19 patient's severity determined the frequency and extent of examination ranging from every 30 minutes to 8 hourly. All patients with predominant neurological presenting complains with minimal risk of COVID-19 (as decided by infectious disease department on basis of history, examination, inflammatory markers, Chest X-ray or HRCT) on initial ED assessment were admitted in primary neurology services contrary to COVID-19 suspected patients who were first admitted in internal medicine services with neurology on consult and later transferred to neurology services once serial swab testing and high resolution CT scan Chest were negative for COVID-19. All patients were evaluated by the infectious team and declared infection free before relocation as per national guidelines.[5] Social distancing became the norm and was maintained during clinical rounds stringently. The round team was dispersed to consist of one attending, one resident and one intern on each bed at a time. Strict policy of one family member per patient was adapted on the premises for counseling and other reasons. Limited nursing staff attended the rounds and was well equipped with PPE as needed. Re-screening of all patients admitted via ER or out-patient clinics was done on the neurology floor. In case of possible COVID-19 symptoms or exposure, the patient was isolated and infectious diseases team was taken on board immediately. Despite taking only COVID-19 negative patients in neurology services, routine bedside aerosol generating procedures e.g. chest physiotherapy, suctioning), a frequent norm in stroke patients, were carried out only if absolutely necessary. Elective admissions for procedures like Botox injections (for movement disorders/spasticity), Immunomodulating therapy (eg Ocrelizumab/Rituximab injections for stable Multiple sclerosis) and therapeutic lumbar punctures (for normal pressure hydrocephalus) were deferred till a safer time. Early discharge became the priority in each patient admitted in the neurology service as soon as they were clinically stable. All required workup was expedited and when possible advised as outpatient to limit exposure and hospital stay. The consults for neurology service were limited to urgent queries only,while others were conducted online or via telephones. Emergency consults for acute stroke service were attended to promptly but only after a quick COVID-19 screening (on the basis of history of travel, exposure, signs/symptoms). National Institute of Health Stroke Scale (NIHSS) used to asses and examine tissue plasminogen activator (tPA) or mechanical thrombectomy candidate in acute ischemic stroke was modified with maximum time spent on either foot end of bedside or maintaining at least a 6 feet distance and touching patient only when absolutely necessary. For suspected or diagnosed COVID-19 patients in the ICU, a focused and concise neurology clinical examination was preferred.

TELE-HEALTHCARE NEUROLOGY SERVICES:

It has been recommended that tele-health should be used in the era of COVID-19 where ever possible, using video ideally, or phone if video is not accessible. By early March 2020, outpatient clinics were limited to semi-urgent care provision only with chief emphasis on tele-clinics. Initially limited tele clinics usually 2 on an average per week with 2-3 patients in each clinic by every neurology attending was initated. But the need increased and currently we are running 4-5 tele-clinics per week having 2 to 8 patients per clinic with an estimated count of 80 to 100 patients per month. COVID-19 screening with basic questioning on travel history, fever in oneself or a family member was done at the reception of outpatient clinics.Details of all patients and accompanying attendants were recorded in the data base. Face masks and hand sanitization were provided and made mandatory for entering hospital premises. An additional stroke clinic was set up once per week urgently for stable patients who had presented to the ER with a stroke but were hesitant to get admitted due to the COVID-19 scare. Provision of speech therapy, swallow evaluation, physiotherapy and rehabilitation were salient features of this clinic.

Main challenges faced was a limited pool of patients with electronic devices and network access at home to avail the opportunity. Limited clinical yield of a visual based examination by the neurologist and rarely poor internet connection from patient's end were some of the other problems faced. There was a sense of social disconnection due to lack of face to face interaction which was mitigated by more detailed counselling and follow up calls by patients in case of any confusion or lack of satisfaction. However, a priority for tele-clinic was given for follow-up patients .Such contact with individuals and caregivers/families alleviated their anxiety and concerns to some extent.[8] Prescription was written by attending and its picture sent via email or Whatsapp on smart phones for documentation purposes and prevention of medication error. As an example to visionary teleclinic services New York University Langone Health (NYULH) was amongst the earliest health systems in the United States to be directly affected by COVID-19. NYULH uses the Epic electronic medical record (EMR) ecosystem with interconnected apps on desktop and laptop computers. Mobile devices are used by physicians for the virtual visits.[9] With limited resources available to the patient in an under developed country, learning to make do with whatever source present is a challenge. Tele-clinics at Aga Khan University Hospital for new/follow-up patients were soon up and running, speech, limb and vocational rehabilitation was taught online either via live stream or serially recorded educational videos for guidance of both patient and their attendants.

MODIFICATIONS IN NEUROIMAGING REGULATIONS:

Neuroimaging remains the cornerstone in management of neurology patients. Due to immense contribution of CT and MRI imaging certain polices were set for prioritizing patients in need of urgent imaging. All the patients arriving for elective imaging were screened as per national guidelines for sign/symptoms or exposure to COVID-19 patients and were made to go through nasal swab testing in case of any suspicion.5 Mechanical thrombectomy services was temporarily halted for 2 months which has resumed now. Any patient catered in radiology with either suspected or confirmed for COVID-19, the institution based protocol of disinfection was applied before another patient was taken for imaging in the same suite. Ancillary testing including Echocardiography, ultrasound Doppler and lumbar punctures were ordered on OPD and non-urgent basis.[10] University of Washington has shared their experience and policy for neuroimaging where they screened patients at risk on basis of hospital based guidelines, maximized portable procedures to traffic-less area preferably under window glass, minimized interventional procedures in non-urgent patients and promoted capability of remote interpretation.[11] The institution ensured to do neuroimaging preferably when COVID-19 PCR sample was sent and negative in non-urgent cases while in urgent cases, radiologist was taken in consensus with ordering clinician in time sensitive cases. As in our case Use of PPE, safety precautions and disinfection was highest priority in radiology unit.

MODIFICATIONS IN NEUROPHYSIOLOGY TESTING:

Ancillary testing was considered mandatory if it changed the management of the patient. To minimize the risk of exposure all neurophysiology procedures were done only after approved by the on-call neurology team comprising of neurology fellow and attending. Neurophysiology department observed a dramatic decrease in patient's volume with average procedures going form 10 to 15 procedures of EMG/NCS (Electromyography/nerve conduction study) per day to 6-8 procedures per day. EEG services also suffered similar disfavor with daily census going down form 10-15 EEG's per day to around half the count. Due to a lack of disposable Electroencephalogram (EEG) leads for recording, reusable leads were used for COVID-19 patients with standard disinfection of apparatus between each procedure.[5] More brief EEGs were ordered compared to continuous EEGs whenever former option deemed possible. Elective procedures of video EEG and sleep studies remained suspended for 2 months which have been resumed now. Neurophysiology technologists were trained formally for proper PPE use and underwent fit testing for N-95 mask. To prevent overcrowding technologists were called on shift basis to minimize contact. Separate portable EEG machines were designated for high risk COVID-19 areas. EEG and EMG- NCS equipment were cleaned before and after the procedure as per institutional guidelines in which they were cleaned with alcohol wipes (containing >70% alcohol) also equipments and electrodes were kept in storage rooms for next 24 hours before re use. In an experience shared by New York-Presbyterian Hospital, USA, EEG equipments were cleaned with hospital-approved Super Sani Cloth Germicidal wipes (EPA # 9480–4). [12]

REVISIONS IN EDUCATION AND TRAINING:

COVID-19 pandemic has taken a toll on standard curriculum based learning in the field of medicine and surgery at large. The obvious diversion of focus from structured training to damage control cannot be denied. Neurology residents and fellows were

temporarily disallowed to attend clinics. To mitigate the effects on training, the main focus was driven to consultation services for COVID-19 positive patients with neurological manifestations and complications. Also within 6-8 weeks, services returned to normal with plenty of primary neurology patients on board along with resolution of out patient clinics for trainees. Trainees were instructed to attend extra clinics to cover up the loss. Two formal fellowships offered in neurology the neurophysiology and neurovascular trainings both suffered.In neurophysiology due to a decrease in all procedures to patients including EEGs, EMG/NCS, VEPs, Botox injections and well as sleep studies.The neurovascular fellowsip due to a decrease in the patient load to ER as well as in and out patients. The long lasting effects of pandemic affecting either ongoing reallocated clinical volume or the need to catch up on differed routine outpatient care cannot be denied.[13] We did see the immediate effects on a few month's cohort, with temporary decline in patients' volume to half as mentioned above for 8-12 weeks. However, as we write the numbers are coming up and expected to normalize in the following weeks. During this period the neurophysiology fellows were constantly sent to COVID ICU and special care units for portable services of EEG and EMG/NCS with safety protocol for COVID-19 related encephalopathy and peripheral nervous system diseases respectively. In order to continue education and training, all sessions that were cancelled initially during complete lockdown of the city were switched to formal online format. Weekly neurology resident teaching sessions are currently conducted by the chief resident or faculty members through Zoom or Microsoft Teams and monthly online assessments being supervised by the residency program director. Furthermore, virtual medicine grand rounds are held on a weekly basis and an online town-hall meeting with the dean takes place fortnightly to provide the updated guidelines, administrative reforms and much needed reassurance to the healthcare workers. Neurosciences regular meetings started on line with regular presentations on Zoom highlighted with COVID-19 and patients with neurological manifestations and complications. The Department of Postgraduate Medical Education requires resident trainees from all sub-specialties to contribute to and maximize the care of critically ill COVID-19 patients. On a fortnightly basis, a neurology resident started being deployed in the Covid-19 ICU unit. Before the deployment ICU related basic training was provided via an online "COVID-19 critical care management" workshop over a span of 4 days. Doctors, nursing staff and paramedics from all over the country were welcomed to register and participate. It included a panel of intensivists, anesthesiologists, emergency care physicians and infectious disease specialists from AKUH and other tertiary care hospitals in Karachi.

EFFORTS AT EMPLOYEE HEALTH CARE:

A "COVID-19 Employee Hotline Service" was created to answer queries and provide urgent screening in case of exposure to a suspected or diagnosed COVID-19 patient. Testing kits are made available for the employees. Efficient scheduling is done to keep a backup team on hold in case any employee, either nurse or doctor, is quarantined. In case of sudden shortage of interns, residents or staff, respective employees are lent from other subspecialties temporarily till the employees could recover to join duties. The test is done on a priority basis and the personnel asked to isolate and quarantine till further notice as per international guidelines. To ensure the physical and mental well-being of the staff, interactive tele-health sessions are being conducted on a regular basis. Psychiatry department has volunteered free mental health support initiative for hospital health care providers in week days. Regular emails and videos covering their heroic efforts also shared by the institute to acknowledge their dedication. Take away meals have been sponsored by the hospital for all health care providers but dine-in service was discontinued to maintain social distancing. While the city was under strict lockdown, transport provision was made for the hospital staff to facilitate them. **'Sehat app'** A dedicated smart phone application was developed by the IT department at AKUH equipped with logistical facility to gather data from self-assessment questionnaires filled by employees to guide them for an elemental action plan. The self-automated application answered concerns about the need of isolation, COVID-19 testing or discontinuation of quarantine. It also had information for specific departments as well as infectious control section to keep a track of the increasing/decreasing numbers of infected health care professionals. It played a significant role in reducing the manual burden on the infectious disease call centers as well as provided a basic health care information system for employees.

EFFORTS AT PUBLIC SERVICE:

The AKUH communications department has played an effective role to spread awareness among the masses as well. There is a COVID-19 helpline made available for the public 24/7 by the hospital for tele-screening, urgent queries and taking appointments for COVID-19 testing. Many social myths have been addressed via

print and electronic media. Frequently asked questions (FAQs) are continuously answered on multiple live sessions online that cover important topics like social distancing, sanitization, the infection spread and severity of the disease and self-quarantine at home. In addition, home care of patients with chronic illnesses and maternal and women health issues have also been addressed. Regular improvisation of safety protocols is done following the international CDC and WHO guidelines to ensure safety and satisfaction of the patients, their families and our hospital staff.

RESEARCH RELATED TO COVID-19:

Neurological manifestations and complications of COVID-19 are diverse including meningitis, encephalitis, transverse myelitis, neuropathy, radiculopathy and musculoskeletal injury. New research studies have been directed towards the ongoing pandemic all over the world. In close alliance with the public health sector, data is being collected and various treatment options are under testing. Declaring at international level, the institution is paving its way to promote nation-wide COVID-19 neurology registry by starting institution based data collection of all COVID-19 patients with neurological manifestations.[14] All other clinical trials and studies that included patient contact have been paused in the meantime. A number of papers have already been published in indexed journals by various departments as we experience the COVID influx of patients and learn from it.[15] Also more than sixty new studies on COVID have been enrolled with the hospital ethical review committee by the department of medicine alone in the last few months since the pandemic began.

SOME IMPORTANT CONCERNS:

But are all these measures undertaken truly sufficient in such devastating times? Some queries in all our minds will only be answered through the test of time. Will the residents and fellows that have had precious time lost in these past months be able to ever catch up on this different approach to Neurology? Will they have ample outpatient experience by the time they end their training if this catastrophe continues indefinitely? Will the trainee doctor consider this hands off approach a norm? Will we concentrate on the quality of health care in reality instead of just build up on the volume loss to compensate for this year? Is the faculty really teaching with the same passion they used to when they themselves were learners? Was the sense of touch and personal care thought to be half the cure for a patient just a façade all these years? Are we doing enough to support the frame of mind of trainees experiencing these tough times?

CONCLUSION:

The aftermaths of this pandemic will be seen in years to come. The impact left behind on the life, education, training and the mental state of each person who lives through the time maybe alarming and requires immense attention. Coping mechanisms need to be taught, tested and sorted out now before devastating long term complications are experienced in the long run. We will require innovative clinical structures with active tele neurology forums and still proceed with sturdy training programs. Collaborative efforts, nationally and globally are the requirement as we continue to learn through clinical experience, trials and research on all the potential complications of COVID-19 in these dismal times.

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