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Mitigating Challenges in Surgical Training During Covid Pandemic

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ABSTRACT
INTRODUCTION: *The sheer overwhelming magnitude of the COVID-19 pandemic has affected ongoing surgical training and put an indefinite pause to conduction of regular and routine surgical exposure of patients and elective cases. This study has been conducted to clearly define the various factors and variables attributable to this problem and address solutions to mitigate the same without affecting the COVID response management.*
MATERIALS AND METHODS: *This is an observational study based on a qualitative analysis of an open ended questionnaire where-in the authors contacted and spoke to 150 surgical and anesthesia residents undergoing their post graduate courses in various training hospitals based in Delhi and Pune along with 30 Faculty members of surgery and anaesthesia and 50 paramedical nursing staff and operating room assistants.*
RESULTS: *The experience of all the subjects were collated into clearly defined parameters addressing the problem and based on their suggestions and analysis, practical and implementable solutions to address the same have been proposed in this study.*
CONCLUSION: *the study focusses on clearly defined and algorithmic approach to firstly understand the problem of undermined surgical training amidst this COVID pandemonium and suggest implementable solutions to mitigate the same without affecting the response required to face the COVID-19 pandemic.*
KEYWORDS: *COVID-19, Pandemic, Surgical training, Surgical Brick, Resource diversion, Cohort*

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I. INTRODUCTION

The COVID 19 Pandemic bloom has hit the population hard whether directly or indirectly[1]. Resource mobilization for mitigating the same has been a two faceted approach. Firstly by inception of new resources hitherto unknown due to the sheer explosive spread of this rather virgin virus and secondly redirecting existing resources to augment the pre-existing framework of medical infrastructure owing to the colossal magnitude of the epidemic. Resource redirection to fight this pandemic has deemed it necessary in developing countries like India, to pause all routine and conventional approach to elective cases in surgery and direct all medical resources into fighting this pandemic[2,3,4]. However the sheer magnitude of the problem with an uncertainty as to its end point has brought into limelight, many challenging facets and consequences of this approach[5,6].

One of the hardest hit aspect in this regard has been an indeterminate pause into continuing conventional medical education and training. While it is necessary to have done so, to effectively fight the Pandemic as a whole and come out unscathed, finding ways to mitigate the same is also a moral obligation on part of practicing and treating surgeons to pass on and practice their art into the future generation.

In this article, the authors have made observations and analysis, based on their studies, to highlight the challenges faced in surgical training and skill development on part of practicing surgeons and resident surgical trainees and also suggest ways and ideas to deal with it. Our approach to addressing this issue is simply by defining the problem at large in very clear cut parameters, and apply a scientific approach to mitigate the same by collating all data and suggestions into clear cut algorithmic paradigms.

II. PATIENTS AND METHODS

This was an observational study based on a qualitative analysis of an open ended questionnaire. In this study the authors spoke telephonically to 150 surgical and anesthesia residents undergoing their post graduate courses in various training hospitals based in Delhi and Pune in India. 30 Faculty members in surgery and anaesthesia were also contacted and their suggestions taken into cognizance and endorsed in this study along with the 50 paramedical nursing staff and operating room assistants.

The various faculty members shared their one year experience of surgical practice and training during COVID-19 and also their suggestions on their take on the optimal utilization of resources and manpower. Practicing surgical and anaesthesia residents undergoing their post-graduate course shared their experience on loss of training hours and hands-on experience along with suggestions to mitigate the same. The operating room

assistants, nurses and paramedical staff also shared their rich experience on the optimal and efficient handling of technical equipment and optimal resource utilization system.

III. RESULTS

Our interviews of dynamically experienced surgical and anaesthesia faculty, residents, paramedical and nursing staff yielded many potential grey areas in existing modus operandi of COVID management and also gave extremely rich and novel suggestions to mitigate the veiled problem of loss of surgical training during the ongoing COVID pandemic.

1. There was a significant lack of clear cut team or brick concept in management of day to day surgical cases whether emergency or elective. 86% of residents, 33% faculty and 100% of paramedical and nursing staff were unaware of the "Brick system" or "revised Unit system" for the same. Though all the institutions had some form of existing brick system, it was mostly an individualized or a very small brick mostly comprising of a single faculty, resident and support staff. The concept of a full multi-speciality surgical team brick was found to be lacking in all hospitals.
2. All the faculty, residents and paramedical and nursing staff admitted that apart from COVID duties or duties in COVID wards, there was a lack of clear cut "surgical COVID-19 response team" and operated on an "On Call" basis to handle COVID-19 related emergencies or emergency surgeries in COVID positive patients. Since personnel on-call had a changeover of duties, there was no clear cut tab on any resident or faculty who possibly contracted an infection, leading to possible future transmission to their colleagues. Majority of the residents and faculty felt that the "on call" system was a redundant system while dealing with such a scenario and needed revision.
3. There was a lack of clarity on the system of well-defined micro-cohorts based on temporal nature of admission of patients and their testing. Admission of patients was in the existing system of large wards with intermingling of different patients admitted on different days and different RTPCR/RAT testing time (generally done during time of initial admission). This allowed potential loopholes for cross infection amongst inpatients who might have been in incubation period during their initial testing or may have contracted the disease from visitors or even infected health care personnel subsequently [7].
4. All residents admitted to a lack of inter-departmental cohesiveness in the domain of surgical training and friction points between departments to conducting surgeries due to differential levels of fatigue and motivation amongst residents and faculty. 60% of faculty in surgery and anaesthesia also reported the same.
5. There was a universal agreement on conduction of video- conferencing training sessions, webinars and classes and also virtual rounds to avoid minimal exposure to existing or potential COVID cases. It was also found that this system currently exists in all the training institutes [1]. However implementation of the same varied from institute to institute depending upon the existing workload and availability of the faculty to conduct the same. COVID fatigue was found to be a major contributor in non-conduction of the structured training program especially during the peak wave time frame. However, the resumption of the structured training through video conferencing or physical classes and clinics extended way beyond the plateauing of the COVID wave. 3 institutes in Delhi and 2 in Pune were swift to resume training after the wave, however all the others, took almost many months (range 1-5 months) to do so.
6. All the involved residents and paramedical staff in the study and at least 50% of faculty suffered from something called "COVID Fatigue" whether be in terms of attitude or mental response in wearing of full personal protective equipment [8,9]. Even while the time period between the two COVID waves, the affected population often resorted to use of just N-95 masks and often junking the use of PPE suits, citing various factors like the uncomfortable sensation, the humidity and severe sweating inside and the frequent inconvenient fogging of face shields and goggles.

We the authors have compiled the same to make certain propositions to deal with this in a way that doesn't hampers the management of the ongoing pandemic and at the same time address this pressing issue in a dynamically competent and responsible manner.

IV. DISCUSSION

A surgical team is never a one man army, rather it's a cohesive group of skilled doctors, nurses and assistants who work together as one entire unit. It consists of surgeons, anesthesiologists, pathologists, medical officers (at times), residents, Internees, Nurses, scrub nurses, matrons, Operating room assistants, housekeepers and runners – each of who has their own critical role in managing every patient at various steps, who either is preparing, undergoing or recovering from surgery.

There are two facets in surgical training. One is the training of surgical trainees in their period of residency and second is the continuous skill development of surgeons and surgical team by regular practice. Undoubtedly both these aspects have been severely affected in the ongoing COVID -19 crisis, where-in manpower resource and amenity diversion deemed necessary that all elective cases be postponed indefinitely

[5,6,8,10]. However, looking closely there are many minute points of study in each human and material resource diversion that needs to be defined and examined in detail to understand the basic nature of the cascade it triggers on such levels. It may well be pointed out that resource isn't restricted to manpower. It also includes space management, technical equipment, ventilators and oxygen which has been quite the rate limiting factor in the current scenario. The same classification standards and definition applies analogously to them.

Resource disengagement from the routine can be classified into the following four categories.

1. Resource diversion
2. Resource distress
3. Resource fatigue and
4. Resource attrition.

Resource diversion is defined as the active resource load diverted to discharging COVID duties [6,10]. Medical fraternity and healthcare workers on active COVID duty managing COVID wards and patients at any step are included in this category. It includes the following

1. Human resources in the form of trained manpower

a. Anesthesiologists to look after severely ill COVID patients on elective ventilation, ventilatory management and ICU patients

b. Staff and scrub nurses to man ICU and critical care units and COVID wards

c. Trained operating room assistants to help in COVID centres

d. Surgeons and resident doctors to augment skilled manpower in managing high load of patients in COVID hospitals

e. Entire hospitals with complete staff converted to exclusive COVID hospitals in compliance with government orders and policies.

2. Space resources in the form of

a. Wards and ICU converted and augmented to be re-designated as COVID wards

b. Exclusive COVID hospitals - existing hospital conversion and creation of new COVID hospitals

3. Technical resources like

a. Oxygen delivery systems, oxygen plants and cylinders

b. Ventilators

c. Drug delivery systems like Infusion pumps, IV lines, cannulas, syringes

d. Drugs and medication

e. Ambulance

4. Non-technical resources like

a. Bed and its associated logistics like linen, blankets, side tables, mattresses.

b. Trolleys, wheelchairs, stretchers

c. Food and medical comforts

5. Fiscal resources and funds diverted and re-channelized towards COVID care.

The time frame of this category is variable and often unpredictable, and cannot therefore be used for planning purposes.

The second category is termed as **Resource distress**. It includes resources – manpower and others which is directly affected or infected by COVID and is under the care of category 1. In terms of manpower it is the group of healthcare workers who are have turned active patients themselves and are need of active medical care. Again needless to say this is a very significant percentage. In terms of other resources, it is the group of equipment and resources utilized by the manpower group in this category whether it be a bed of a COVID infected surgeon or oxygen, equipment or resources used on a COVID positive resident on a ventilator. The time frame of this is again variable and depends on the resource in question.

The third category of **Resource fatigue** encompasses category two subjects who are recovered but are either in convalescence, quarantine or isolation are hence not on active duty [6,10]. In terms or inanimate resources it also includes ventilators, tubing and drug and oxygen delivery systems which are currently undergoing sterilization or disinfection and therefore in a phase of temporary after-use "fatigue," again not fir for use immediately. In many places this time frame is generally defined and depends on place to place as per the prevailing hospital policy.

The fourth and final category of **Resource Attrition** includes the unfortunate cohort of healthcare workers who succumbed to the disease valiantly or rendered unfit for active duty due to residual disability. By definition it has to also include healthcare workers who have been psychologically affected or demotivated to continue their duties further. Also in terms of other resources it includes damaged, destroyed or consumed equipment which can no longer be used for active healthcare needs until it is completely replaced by new resource injection into the system. It also includes loss due to wastage, defective or re-furbished, pilferages and damages. This category is the most variable one in terms of time and predictability and is often governed by basic human instinct, motivation and behavior and currently no measurement model is capable to accurately give an estimate of this.

After having defined these parameters of concern and identifying clearly the shunting of variables into the COVID problem, we attempt to propose measures to mitigate the same. The following propositions have been made by the authors after having spoken to the various subjects in question as described in Materials and methods and Results, and also analyzing their suggestions and recommendations. It is to be clarified beforehand that a few or many of these proposed systems are already in place in many hospitals and in-fact many institutes have their own plan which is dynamic depending upon the patient load and availability of manpower and infrastructure. However, a comprehensive approach to deal with such challenges was often found lacking due to a short-sighted approach or to deal with situations on a need-to-need daily basis. Also to add in this regard, no single subject or researcher is a complete authority in this and since the challenges are evolving and new to face with, in fact no one can truly be regarded as a complete or absolute authority but is rather a dynamic process of evolving and learning. We are still learning and evolving to deal with the challenges given to us and suggestions from all of us may be utilized to formulate a full-proof policy for mitigating these challenges of lagging surgical training and growth during the ongoing COVID pandemic [8].

1. Re-introducing and re-structuring the concept of "Unit" system or "Brick system" of duties. A Surgical Unit in a training institute traditionally used to comprise of surgical professors and faculty, unit heads in surgery, senior residents, junior residents from third, second and first year of surgical residency, internees and medical officers. All units structured to report to or work under the consultant or head of department. A new revised unit called a "COVID Surgical brick" would be designed to consist of an entire team of Surgery and Anaesthesia faculty and professors, Senior and junior residents including an equitable distribution of third, second and first year residents, medical officers, Internees, and also now expand to include Nurses, Operating and nursing assistants, housekeepers and support staff. It is envisaged that while most of anaesthesia work force is shunted to deal with COVID and rightly so, this BRICK surgical unit should have the bare minimum anaesthesia support in the form of a single faculty and resident in it. In centres where the shortage of manpower doesn't allow even this, a single faculty can head over various surgical brick units which may just have a senior resident reporting to and being governed by the same single faculty for the same. At least 4 such Surgical brick units are proposed to be functional at any point of time –

a. First operational brick to look after COVID related surgical emergencies – like emergency surgeries on COVID positive patients or surgical interventions like tracheostomy in COVID positive patients on prolonged ventilation,

b. Second operational brick to look after non- COVID surgical emergencies

c. Third operational brick to look after elective and routine cases

d. Fourth and final brick in quarantine or convalescence as described above in Category 3 namely "Resource fatigue". this particular Brick may either be the consequence of one after dealing with sub point "a" or a unit in which team members have been infected or affected by COVID in an unrelated or independent event as described in Category 2 or "Resource distress"

The rotation of these surgical bricks may be decided as per existing hospital policy or endemicity to be a time span of three weeks at the bare minimum so that the continuity may be maintained in surgical training and practice and at the same time allowing affected team members to recuperate from being affected.

2. While the peak of pandemic exists, it is imperative to halt all elective cases, there are certain subsets of surgery which do not halt in any case, for example trauma, oncosurgery, vascular and neurosurgical emergencies, paediatric and neonatal emergencies, gynaecological emergencies like caesarian sections, high risk pregnancies, ante and post-partum hemorrhage management etc, designation of a dedicated surgical brick to address these cases is a must [3,4,8]. As described in the previous recommendation, the second brick is to be designed and designated for addressing this.

3. Pre-operative COVD-19 detection by RTPCR should be attempted for all patients undergoing emergency or elective surgery [2]. In elective cases it is recommended to mandatory. In emergency cases, a Rapid Antigen testing must be done while the patient is in pre-operative workup or resuscitation phase before wheeling into the operation theatre. Sample collection must also be done for COVID testing by RTPCR, report being made available subsequently and actions taken. This however doesn't imply that personal protective equipment (PPE) be divulged with during operating. All precautions has to be taken while the COVID pandemic is still on [8].

4. In this regard, it is also important to segregate emergency and elective operating theatres so that patients not tested by RTPCR and those tested are not clubbed together [2]. The same fundamentals goes for post-operative wards and intensive care units also so that in case post-operative RTPCR turns positive, patients do not contract COVID-19 during their hospital course [7]. This system would negative potential loopholes for cross infection amongst inpatients who might have been in incubation period during their initial testing or may have contracted the disease from visitors or even infected health care personnel subsequently [5].

5. The system of segregation also makes us re-look into our existing healthcare set-up of a "Ward" based system to a more sophisticated "Cabin" based system of hospital management [8]. It is understandable in developing countries that this takes a massive infrastructural undertaking and change over, however our future

insight and vision should envisage to learn from this lesson and make necessary modifications in re-designing our future projects or hospitals. Due to constraints of space and resources, it may not be practical to transform existing system into individual cabin based arrangement, however breaking up of large wards into smaller cohorts (of 4 to 6 patients) each with proper partitioning and distancing of cohorts would probably be a more realistic and practical way of achieving this. An easy way to this is to simply create separate facilities and chambers for pre-operative and post-operative patients [4,8] .

6. Video-conferencing based tele-mentoring of clinical meetings, rounds and case discussions to perpetuate a continuing medical education is also an important aspect of dealing with the current pandemic scenario [1]. Surgical conditioning by regular video conferencing classes, mannequin based surgical skill enhancement and options of cadaveric teaching of surgical methods should also be explored to skill enhancement and keeping the practice well-oiled during these trying times [11,12]. It need not be over-emphasized that cadaveric based teaching should be practiced in COVID-19 negative cadavers only. An increasing partnership with the department of anatomy will also go a long way in this regard.

7. Lastly we also suggest that even while routine cases of elective surgery are carried out in RTPCR negative patients for COVID-19, we must also inculcate the habit and practicing surgery in full protective equipment like PPE suits, Face shields and respirators enabling the upcoming and practicing surgeons to get a hang of the whole paraphernalia, considering that this will now be the "New Normal" [8]. Technical issues like fogging of face shields, respirators, breathing through double and N-95 masks, dealing with the humidity and heat inside the PPE suits can only be dispelled by achieving a level of comfort by regular usage of the same [9]. It is an arduous, tiring and mentally constraining armamentarium however necessary it is, but fear and hesitation can only be done away with by its regular usage for better acceptance and practice.

Many of these above mentioned plans are in place in institutions, however the attempt of this study is to learn from the rich experiences and mistakes and evolve our health care systems. We need to firstly understand the challenges and magnitude of the problem, define the parameters of concern, take stock of all the available resources and chalk out a plan of action keeping these points in mind. We must also take this as an opportunity to inculcate a futuristic approach to our on-going hospital projects and ward construction designs so that any such similar calamity may be dealt with in an efficient manner. COVID-19 is just an example of what future epidemics may look like, and therefore this study isn't just about dealing with a COVID pandemic but about all possible future epidemics and pandemics, where-in academic surgical training needs to go hand in hand along with mitigating the problem at hand.

V. CONCLUSION

To conclude, this study was conducted to highlight the various challenges faced by the surgical community as regards to smooth and frictionless conduct of surgical training during the ongoing COVID pandemic. Since there is no full-proof epidemiological or mathematical model to clearly predict the end point of this pandemic, it has been envisaged that surgical training needs to go hand in hand in a way that neither affects the management of the pandemic nor puts an endless pause to surgical training in the making of new surgeons or ongoing surgical conditioning. This study clearly defines the re-direction of various manpower and technical resources so that the awareness of the same can help training institutes and hospitals in planning out their resource allocation to address both these issues with minimal or no adverse effect on the other. It is endeavored that with the knowledge of these various variables enlisted above and following the suggestions as analyzed in this article, the surgical fraternity can introduce changes and measures in mitigating these challenges effectively. COVID-19 gave us a glimpse as to what and how a future pandemic may look like and therefore the methods postulated in this study is not necessarily restricted for COVID-19 alone. This study may also be taken as a framework over which our future action plans may be designed to deal with any pandemic or epidemic of such proportions.

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