

Managing the COVID-19 pandemic – innovations, adaptations and leadership

Anjan Dhar^{1,5}, Shafie Kamaruddin², Paul Peter², Stephen Cowie³, Anthony Allan⁴

Departments of Gastroenterology¹, Endocrinology², Respiratory Medicine³, and Acute Medicine, Division of Integrated Medical Specialties, Darlington Memorial Hospital, Co. Durham; School of Health and Life Sciences⁵, Teesside University, United Kingdom.

The COVID-19 pandemic in the United Kingdom has forced hospital teams to work under severe constraints of workforce, personal protection equipment (PPE), intensive care beds and ventilators. Individual hospitals have had to come up with organisational plans to manage the huge numbers of patients, some very elderly being admitted daily for over 4 weeks. We report our experience of preparing for the epidemic, workforce planning, training junior doctors and nurses in the management of COVID-19 patients at Darlington Memorial Hospital in County Durham, developing a risk stratification and ward round assessment proforma, rational allocation of personal protective equipment according to RAG (Red, Amber, Green) rating of wards based on the World Health Organisation definition of aerosol generating procedures (AGPs), building a brand new Acute Respiratory Unit (ARU) for continuous positive airway pressure (CPAP) ventilation and developing a multi-disciplinary (MDT) meeting for invasive ventilation in intensive care units (ICU).

In preparation for starting the intake of COVID-19 patients, we developed a Command Control Centre which met with all Consultants each morning to plan the staffing of all wards, and allocated trainees to areas where there was a need. We created a What's app® group for the Core Consultant group to communicate easily and rapidly. This enabled us to deal efficiently with issues like sickness reporting and arranging cover at a short notice and also

sharing good practice and guidelines which kept evolving during the course of the pandemic. A brand new 8-bedded separate stream of Respiratory Emergency Care was created in the Accident and Emergency Unit of the hospital (called the Respiratory ED), manned 24x7 by a specialist trainee and a Consultant Physician to triage patients coming to the hospital from the community and with access to portable radiology. Triage was followed by nasopharyngeal swab collection for SARS-CoV2 RT-PCR testing, a portable chest x-ray, blood tests, clinical frailty scale and treatment escalation planning. Two 30-bedded wards were created on the Surgical Floor for COVID assessment ward and COVID positive patients, with appropriate PPE and staffed by a Consultant and 4-5 trainees, 8am-5pm, seven days a week. A robust triaging system in the non-Respiratory ED ensured that non-COVID emergency presentations were dealt promptly by the relevant medical and non-medical specialities. Our existing Acute Medical Unit (AMU) became a hybrid AMU with integrated Same day emergency care (SDEC) looking after unwell non-COVID patients with Consultant Acute physician cover.

A COVID-19 risk stratification proforma (Appendix 1) was created and used daily to identify the highest risk patients who might need respiratory support and invasive ventilation. An ICU suitability assessment was carried out by designated anaesthetists daily for these patients and decisions ratified at an afternoon multi-disciplinary team (MDT) meeting. Patients who had a SpO₂ \leq 93% and a SpO₂/FiO₂ ratio of <315 mm Hg were considered for non-invasive or invasive ventilation. Patients who had a Clinical Frailty Scale of ≥ 5 were assessed according to the NICE Critical Illness Algorithm and referred to Palliative Support team for deterioration and end of life care. Routine non COVID-19 patients were moved to 3 other wards on a separate floor.

In order to reduce the risk of hospital related transmission of disease, visiting by family members was completely stopped during this period but digital technologies such as smartphone video calls and iPad video meetings were allowed. Furthermore, we opened up 3

wards on a cold site non acute hospital where all non COVID-19 patients and some COVID-19 positive patients who had recovered could be transferred for rehabilitation and interim palliative care before being returned to their usual place of stay. The Royal College of Physician SPACES (Sharing Patient Assessments Cuts Exposure for Staff) approach was adopted on COVID wards and medical and nursing staff trained to use this model. Elective outpatient clinic activity was limited to a few urgent face to face clinics at our non-acute cold site and virtual telephone or digital clinics. Endoscopy activity was severely restricted to emergencies only in keeping with the national British Society of Gastroenterology guidelines.

We also developed a database for COVID-19 to collect data on clinical epidemiology, respiratory and non-respiratory symptomatology, blood investigations including risk prediction using CRP, lymphocyte counts, platelet counts and SpO₂/FiO₂, radiology and ventilation need. Our initial figures between 15th March 2020 – 14th April 2020 show a total of 399 positive RT-PCR test results in the geographical catchment area of County Durham, of which 268 were in non-admitted patients and 131 in admitted patients. Of this number 51 were admitted to our hospital. The overall hospital mortality for Covid-19 related admissions on 18 April 2020 in the County Durham was 104, which is 0.7% of the total national mortality of 13918 deaths.

In summary, our experience shows that it is essential to plan every aspect of a pandemic hospital management well in advance from dedicated areas for assessment and triage, protocols for escalation and palliative care, non-invasive and invasive ventilation, staffing and PPE etc in order to be able to manage the needs of the community and not be overwhelmed by the rapid increase in numbers of patients admitted to the hospital. This strategy also keeps mortality to the lowest possible, with a clear understanding that the elderly and frail patients will die from COVID-19 disease, but they will be looked after with dignity in their last moments.

Selected Reading:

1. Singer AJ, Morley, EJ, Henry MC. Staying ahead of the wave. *N Engl J Med*, Online first. DOI: 10.1056/NEJMc2009409.
2. Christian MD, Sprung CL, King MA, Dichter JR, Devereaux AV, Gomersall CD. Care of the Critically Ill and Injured during pandemics and disasters: CHEST Consensus Statement. *Chest* 2014;146:e61S-e74S.
3. Bhatraju PK, Ghassemieh BJ, Nichols M, Kim R, Jerome KR, Nalla AK, et al. Covid-19 in Critically Ill patients in the Seattle region – case series. *N Engl J Med*, March 30, 2020. Online first. DOI: 10.1056/NEJMoa2004500.
4. Fineberg HV. Ten weeks to crush the curve. *N Engl J Med*, April 1, 2020. Online first. DOI: 10.1056/NEJMe2007263.
5. SPACES. Royal College of Physicians London, Version 1, 27 March 2020. (Online). www.gov.uk/government/publications/wuhan-novel-corona-virus-infection-prevention-and-control

COVID- 19 RISK ASSESMENT SHEET

Patient Sticker:

Frailty Score:

Comorbidities:

Escalation Plan:

Day on ward:	
Days since onset of symptoms:	
Oxygenation:	Saturations: Oxygen therapy:
SaO2 to FiO2 ratio: (Divide saturations by FiO2 as decimal e.g. 80/0.60 = 133.3) <315- impending ARDS <200- ARDS	
Bloods:	CRP >100: YES / NO ALT >150: YES / NO Neutrophil to lymphocyte ratio >3.5: YES / NO Platelets <100: YES / NO Lactate >2: YES NO ALP: Rise? YES / NO Value of rise: D Dimer: AKI: NO / STAGE 1 / STAGE 2 / STAGE 3
Examination findings: (please only exam if absolutely necessary)	
CXR	
VTE Prophylaxis	

SEE REVERSE FOR POOR PROGNOSTIC FACTORS AND CRITERIA FOR ITU REFERRAL

BROAD CRITERIA FOR ITU REFERRAL

(Use in conjunction with NICE rapid guideline on COVID 19 critical care)

Category	Clinical status	Suggested action
Green	RR \geq 20bpm with SpO ₂ <94%	Administer O ₂ <40% by face mask, observe.
Yellow	RR \geq 20bpm with SpO ₂ \leq 94% on FiO ₂ >40%	Start 15L/min O ₂ via non-rebreathe mask <u>Senior clinical review to consider:</u> Trial CPAP 10cmH ₂ O with FiO ₂ 0.6 non-vented mask. If further escalation appropriate, consider increasing CPAP 12-15 cmH ₂ O + 60-100% oxygen if needed. Consider BIPAP if at risk of hypercapnia. ALL PATIENTS FOR CPAP SHOULD BE DISCUSSED WITH ITU FIRST.
Red	RR \geq 20bpm and SpO ₂ \leq 94% on 15L non-rebreathe. Rising O ₂ needs, clinical deterioration, not tolerating CPAP.	Urgent critical care review and prepare for intubation if in accordance with TEP

ESTIMATING FiO₂

Method	O ₂ flow (l/min)	Estimated FiO ₂ (decimal / %)
Nasal cannula	1	0.24 / 24%
	2	0.28/ 28%
	3	0.32/ 32%
	4	0.36/ 36%
	5	0.4/40%
	6	0.44/44%
Nasopharyngeal catheter	4	0.4/40%
	5	0.5/50%
	6	0.6/60%
Face mask	5	0.4/40%
	6-7	0.5/50%
	7-8	0.6/ 60%
Face mask with reservoir	6	0.6/60%
	7	0.7/70%
	8	0.8/80%
	9	0.9/90%
	10	0.95/95%

Appendix 2. The Red, Amber and Green rating of wards in relation to PPE

COVID-19 Higher Risk Cohort Isolation Area - Red Zone

A ward/dept with COVID-19 patients (potential, suspected or positive) with high risk of Aerosol Generating Procedures (AGP's) being performed.

DONNING/DOFFING STATION TO BE SITUATED WITHIN WARD/DEPT DOOR

PPE to include - FFP3 RESPIRATOR (eye protection – risk assess) AT ALL TIMES

Gown for sessional use* if no patient contact

If patient contact, don apron and gloves over gown.

After patient contact doff gown, apron and gloves and perform hand hygiene.

COVID-19 Cohort Isolation Area – Amber Zone

A ward/dept where COVID-19 patients (potential, suspected or positive) are being cohorted in areas outside of the isolation rooms (i.e. nursed in bays). **No AGP's**

DONNING/DOFFING STATION TO BE SITUATED WITHIN WARD/DEPT DOOR

PPE to include – SURGICAL MASK (eye protection – risk assess) AT ALL TIMES.

For patient contact, apron and gloves (apron and gloves to be changed between patients).

A&E (respiratory) follow COVID-19 Cohort Isolation Area precautions – (Amber Zone above), EXCEPT WHEN IN RESUS WHICH IS A HIGHER RISK COHORT ISOLATION AREA

NON COVID-19 Area – Green Zone

A ward/dept where COVID-19 patients (potential, suspected or positive) are being nursed in the isolation rooms only. **No AGP's**

NO DONNING/DOFFING STATION REQUIRED.

PPE to be worn – surgical mask, eye protection (risk assess), apron and gloves when within 2 metres of the patient or entering a bay or isolation room.

PPE to be removed when exiting isolation room or bay and is not required to be worn in any other area.

*sessional use is defined as carrying out of tasks i.e. ward round, tea round etc.

Fluid repellent surgical mask can be worn until moist/wet on the inside or is visibly contaminated or damaged.

FFP3 respirator can be used for up to 12 hours –if removed for any reason, it must be disposed of.

An area will be provided for staff to doff PPE and rehydrate. This should be carried out regularly.