Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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Plastic physicians: The surgical salamanders of the COVID-19 pandemic

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Summary At the time of writing, coronavirus disease-2019 (COVID-19) has affected 6.42 million people globally and over 380,000 deaths, with the United Kingdom now having the highest death rate in Europe. The plastic surgery department at Leeds Teaching Hospitals put necessary steps in place to maintain an excellent urgent elective and acute service whilst also managing COVID-positive medical patients in the ward. We describe the structures and pathways implemented together with complex decision-making, which has allowed us to respond early and effectively. We hope these lessons will prove a useful tool as we look to open conversations around the recovery of normal activity.

Introduction

At the time of writing, coronavirus disease-2019 (COVID-19) has affected 6.42 million people globally with over 380,000 deaths, with the United Kingdom (UK) now having the highest death rate in Europe.[1] Leeds Teaching Hospitals (LTHT) is one of the largest and busiest teaching hospitals in the UK, which employs 18,000 staff members across seven hospitals with a total of 2000 beds and treats over 1.5 million patients a year.[2] Currently, LTHT has recorded 301 deaths and 545 discharges of patients' with COVID-19.

Our department receives regional and national referrals for specialist breast, head and neck, sarcoma, skin cancer, limb reconstructive and restorative surgery, including brachial plexus injuries and complex children's hand surgery. We are also privileged to run a national hand transplant service. We have strived to maintain both urgent elective and emergency care alongside providing primary medical care for inpatients' diagnosed with COVID-19. We believe these lessons are critical in helping guide our return to normal activity, and hope that by sharing our experience from the start of lockdown on 23rd March to the commencement of the first stage of recovery on 5th June,

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we can open conversations and discussions around providing specialist care in the ensuing months.

Trust response

The clinical director of Trauma and Related Services is a senior consultant plastic surgeon and an integral part of the trusts response to the COVID-19 pandemic. As the situation evolved, complex senior management decisions were communicated through regular Microsoft® Team meetings. We learnt from events unfolding in London, and planned a strategic trust-wide response prior to the first COVID-19 positive patient in Leeds.

An incident control centre consisting of Gold (strategic), Silver (tactical) and Bronze (clinical speciality unit) command was formed and tasked with preparing the trust's response to the expected influx. Based on modelling, Leeds was expected to peak in COVID-19 cases around the 15th of May, with a bed occupancy of 5025. Revised modelling moved this peak to the 14th of April, reducing the time available to put the necessary measures in place.

Numerous innovative work streams were used to increase the existing inpatient capacity by 800 beds and acquire 275 critical care beds with ventilators. We sought additional equipment, real estate and staff. A National Health Service (NHS) nightingale hospital in Harrogate was commissioned to accommodate the excess. All routine services were immediately suspended. Within two weeks, all acute and urgent elective operating at Leeds General Infirmary (LGI) was condensed into paediatric operating suites (seven theatres), resulting in the amalgamation of services but maintaining our specialty independence. The adult suite (16 theatres) was repurposed into 'pods' with each theatre providing three critical care beds with many of our plastic surgery operating departmental practitioners caring for these patients. All outpatient facilities were reduced and redeployed to a peripheral hospital, with increased numbers of patients being discharged to community intermediate care beds, to ensure a low number of inpatients ready for the expected influx. At the same time, the NHS gained access to both the Nuffield and Spire hospitals. These wards were redesignated as wards of LTHT and were given access to the same software packages used throughout the trust. Like the rest of the world, we faced challenges in sourcing personal protective equipment (PPE) and constant guidance changes. However, the response of all staff members from both clinical and non-clinical areas has been inspiring.

Many parts of our estate underwent a refit to accommodate greater flow rates of oxygen and whilst this work was undertaken, the plastic surgery ward became the first designated ward for COVID-19 positive medical patients at the LGI between 1st of April and 22nd of May.

Departmental response

Early in our response, consultants were divided into subspecialty areas of adult hand surgery, skin cancer, sarcoma, acute microsurgical trauma, transplant and children's services. We remained united as a plastic surgery team but expanded our responsibilities by caring for COVID-19 patients who did not require intubation or CPAP and managed the Emergency Department's paediatric minor injuries unit together with our orthopaedic colleagues. We continued to provide an urgent elective service and as such were able to maintain some effective training and teaching for the trainees.

Rota changes

It became evident that the rota would need to accommodate changing service requirements, staff sickness and isolation periods. The trainees were divided into 'hot' and 'cold' teams to allow service provision to continue across sites but without cross over. The introduction of standby days allowed for surplus staff to be available at home and allowed flexibility for cover. This was crucial in maintaining minimum service levels in the early days of the COVID-19 outbreak where several members of staff were unwell and isolating. The distribution and allocation of staff were regularly reviewed as service demands changed, team debriefing was delivered through video call to ensure the strategy met clinical needs.

Ambulatory day case hand trauma

The acute hand surgery pathway was relocated off the main site to Chapel Allerton Hospital (CAH). This provided an ambulatory one-stop clinic for acute hand trauma with a daily consultant clinic supported by extended scope practitioners, physiotherapy, occupational therapy and a dressing clinic. This enabled us to rapidly see and manage patients, reducing hospital attendances and follow-ups accordingly. Trauma triage referrals reduced in this period and telephone consultations were used for simple uncomplicated injuries. General practitioners and community nurses were provided with an email address for queries and as a route to refer new paediatric and adult sarcoma cases, Erb's palsy and adult nerve injuries.

Daily hand trauma lists continued every weekday, supported by specialist plastic surgery theatre staff and anaesthetists skilled in regional block anaesthesia. The number of patients treated at CAH are summarised in Table 1.

Injuries due to interpersonal violence reduced during lockdown but DIY-related injuries and cases of deliberate self-harm rose in the same period.[3] These patients were supported with access to mental health and support teams.

> 'Working together as one in a co-located environment really allows us to learn from one another, deal with patient problems early and effectively and harnesses our teamwork to the benefit of our patients'.
>
> Suzanne Arnold - Senior Sister Plastic Surgery Outpatients

> 'There is a sense that physical appointments in the future will be precious and scarce and we have been more aggressive in early discharge of trauma cases combined with thorough discussion of timings and recovery and this is likely to become the new normal'.
>
> Fiona Jones - Extended Scope Practitioner

Table 1 The number of people seen and treated by the ambulatory day case hand trauma unit at CAH.

Week	Clinic New	Clinic F/U	Dressings Clinic	Hand Dressings Clinic	Total
1	45	9	22	32	108
2	33	18	28	26	105
3	12	26	29	27	94
4	19	15	35	24	93
5	24	14	53	23	114
6	18	15	42	26	101
7	40	21	50	31	142
8	13	12	48	32	106

Table 2 Acute operative numbers performed during COVID-19 lockdown.

Cases	Numbers
Open lower limb fracture free flap (gracilis)	5
Open lower limb fracture (local flap)	3
Open lower limb fracture (directly closed)	2
Open lower limb fracture (skin graft)	1
Open lower limb fracture (Vac)	1
Necrotising fasciitis	3
Upper limb free flap (groin and lateral arm)	2
Major nerve repair	2
Joint cardiothoracics: Sternal rib resection and reconstruction	1
Foot replantation	1
Multiple digit replantation	1
Common peroneal nerve exploration	1
Joint neurosurgical case: LD and fasciocutaneous flap	1
Others GA/inpatient trauma	45
Ambulatory day case hand trauma	158
Total	**227**

Table 3 Urgent elective operating numbers performed during COVID-19 lockdown.

Cases	Numbers
Skin cancer (LA day case)	169
Skin cancer (GA or regional)	24
Sarcoma (adult and paediatric)	30
Paediatric brachial plexus	4
Adult brachial plexus	3
Joint orthopaedic urgent elective cases	3
Groin dissection	2
Neck dissection	2
Sentinel node biopsy melanoma	3
Liver transplant (microvascular anastomosis)	3
Axillary dissection	1
Major nerve	1
AP resection and IGAP reconstruction	1
Total	**246**

Acute adult and paediatric services

We recognised the importance of remaining open as a regional centre for major trauma and had dedicated microsurgical teams available each day. The major trauma centre admitted 12 open lower limb fractures in this time, we performed eight microsurgical free flaps. A complete list of acute activity can be found in Table 2.

The paediatric minor injury unit transferred to children's plastic and orthopaedic surgery with 131 treated patients.

Elective adult and paediatric services

We have continued to provide urgent elective services, supported by national and local guidance with social isolation and COVID-19 preoperative screening, communicated down to our patient population by our secretarial staff. A breakdown of our elective cases can be found in Table 3. No elective or acute plastic surgery patient developed COVID-19 during hospital admission.

Skin cancer

The skin cancer service provided a daily, consultant-led all day local anaesthetic excision service for SCC, melanoma and any potentially malignant lesion. Melanoma was managed as per the national guidelines, which had been principally written by the lead clinician.[4] Multidisciplinary team (MDT) meetings continued with the minimum number of staff and social distancing. Patients were assessed in a virtual telephone clinic and attended a one-stop treatment episode where needed. Results were given to patients over the phone, only returning to clinic if concerned about recurrent cancer.

The Sentinel Lymph Node Biopsy (SLNB) service was temporarily suspended, and recommenced on the 30th May for those who would be most likely to achieve a stage IIIB minimum if the sentinel lymph node were to be positive. Patients who had been booked for SLNB prior to the onset of lockdown were returned to their local hospital for wide local excision. Systemic anti-cancer treatment continued for patients with stage IIIC melanoma patients and above, but as the number of COVID-19 admissions declined because of the effect of lockdown, this was later revised to include stage IIIB patients.

Sarcoma

The weekly sarcoma MDT continued, with only essential staff in the room and other members joining through video or telephone connection.

We continued to offer all our services including pre- and post-operative radiotherapy. Patients with tumours that were large, and/or high grade and/or close to vital structures were prioritised for surgery. Only patients requiring immediate surgery were brought to face-to-face clinics with the majority of consultations conducted by the cancer nurse specialists through telephone. Follow-up appointments for necessary post-operative wound checks were conducted by the plastic surgery dressing clinic staff at CAH.

Obstetric brachial plexus injuries and children's services

We continued to receive referrals for obstetric plexus injuries throughout lockdown. New and follow-up patients were assessed by using a multidisciplinary approach (surgical team, physiotherapy and occupational therapy) through the software NHS England Attend Anywhere and Microsoft® Teams. This presented several challenges for examination and assessment. Parents were encouraged to have a family member present to help with examination and camera coordination. The treatment pathway remained unchanged, unless there were specific risks that required alteration to the surgical timing. Two children with sarcoma had excisional surgery, with one requiring a free groin reconstruction to the dorsum of the foot. A decision to delay neurotised muscle transfer was made in the second case to minimise risk and allow the continuation of the chemotherapy and radiotherapy programme. All other congenital hand surgeries were suspended with virtual consultations for urgent referrals only.

> 'The hardest thing for me has been to adapt to new parents who have been referred in because their child has a plexus injury. We spend a lot of one on one time with these parents - introducing them to the team, explaining who we are and what we do and addressing their concerns. Our patients are with us for a long time and we develop these relationships early. It is hard to see that aspect of my work change'.
>
> Sarah Taplin - Senior Therapist (children's hands and hand transplant team)

Nerve injury in the intensive care unit (ICU)

Patients in the ICU who are being nursed in the prone position may develop compression and traction injuries to the nerves of the upper limb. Our therapy teams provided guidance to ICU teams on safe positioning and prevention and maintained follow up on these cases. Only one patient required ongoing specialist care.

Hand transplant service

We continue to provide an outpatient service using telecommunications and maintain regular contact with this shielded population.

COVID-19 medical ward

The 25-bed plastic surgery ward was the first designated admission ward for COVID-19 positive medical patients at the LGI: led by twice daily plastic surgery consultant ward rounds and staffed by plastic surgery doctors, advanced care practitioners, nurses and physiotherapists.

We received support from our colleagues in palliative care and respiratory medicine who helped with advice about rapidly evolving and changing guidance. Technologies such as Microsoft® Teams, Zoom and WhatsApp® allowed all parties to stay in touch and trouble shoot. Over this seven-week period, from 1st April to 22nd May, we had 86 admissions, 51 discharges, 18 non-ITU inter-hospital transfers, 8 transfers to critical care and 10 deaths (Figure 1).

From the outset, all team members were understandably anxious. For many it had been several years since their last medical rotation, with some even joking that they would not know where to look for their stethoscope. We had little knowledge of the disease or progression and were alarmed by media reports from Italy and daunted by the effects it had already had on our colleagues in London. Many of us left our families to minimise the risk to loved ones and accepted that at some point, we too would be personally affected by COVID-19. Working alongside our trusted plastic surgery colleagues and friends has been invaluable during this mentally and physically challenging period.

Seeing patients struggle with breathing problems, away from their relatives and dying was extremely difficult for us all, and we instantly understood the impact this disease was going to have. The end-of-life decisions were particularly challenging, given limited communication with family members; however, we learnt to address these issues early on by maintaining open and sometimes difficult conversations with patients and their relatives. It is worth noting that once PPE guidance had been established, and staff were wearing what was recommended, no medical or nursing personnel became unwell with symptoms of COVID-19.

> 'The biggest challenge for the nursing staff has undoubtedly been palliating dying patients. We learned new skills and used new technologies to help families stay in touch during those last days and feel honoured and privileged to have been able to offer that emotional support'.
>
> Joy Matanga - Ward Sister Plastic Surgery

> 'I have been providing support over the past number of weeks, and have found the whole plastic surgery team to be diligent, efficient, and professional'.
>
> Dr Laura Horgan – Respiratory Consultant

> 'Hearing that we were to receive COVID-19 patients was daunting, and provoked many worries amongst the team. However, we've used the experience to broaden our knowledge base in medicine so that we can care for our patients appropriately'.
>
> Lily Smith – Staff nurse

Educational opportunities

To maintain educational opportunities, we used YouTube, Zoom and WhatsApp® to deliver educational content.[5] In

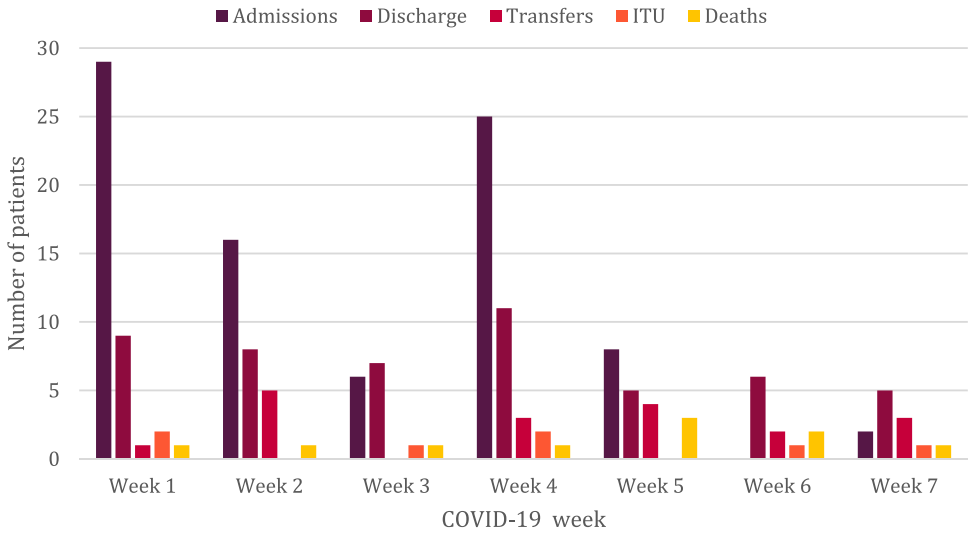

Figure 1 COVID-19 medical patients admitted under plastic surgery.

addition, our junior doctors provided vital teaching on basic medical tasks such as blood gas and ECG interpretation, completing death certificates and electronic discharge letters to members of our department and to wider audiences in training sessions set up by the Trust.

We maintained surgical skill proficiencies throughout lockdown by allocating a trainee to the urgent elective cases, and more recently, have extended our elective operating allowing for more opportunities.

> 'I came from Sydney, Australia to Leeds because of its prestigious reputation. Once the gravity of the COVID-19 situation had become apparent, I decided to stay as I was able to continue some of my work in hand trauma, lower limb microsurgical reconstruction and sarcoma surgery. One of the most valuable experiences I had was gaining an insight into how to manage finite medical and surgical resources in a pandemic. I also had the opportunity to contribute my pre-surgical training medical skills to the NHS, by managing the care of COVID-19 patients. I am proud and privileged to have had this learning experience during my Fellowship, in such a devastating time'.
>
> Mr Vincent Choi – Microsurgical and Hand Fellow

Moving forward

We are now tasked with restoring surgical activity. Referrals have been ongoing throughout the pandemic, and LTHT now have a waiting list of over 250,000 patients. A surgical template has been formulated to give the necessary capacity to each speciality, in familiar theatre locations. To achieve this, the extra critical care capacity had to be disbanded, but with a plan to escalate back should there be a second peak. As lockdown is gradually eased, we expect a rise in the number of acute referrals. Our hand unit has moved back to its original base in LGI, so we can safely accommodate this. Medical patients in the independent sector are currently being repatriated, so elective surgery can continue there under the NHS.

These changes have been made alongside the evolving guidance on screening patients. Elective patients and their families must adhere to a strict 2-week isolation period and have a negative pre-operative swab at 48 h. New pathways are being established to ensure that 'hot' and 'cold' areas remain separate. A designated COVID-19 theatre remains for urgent or high-risk cases, where a swab result cannot be obtained in time.

As we continue to move forward, outpatient clinics will restart with minimal face-to-face consultations. Changes have been made to outpatient areas to ensure compliance with two-metre social distancing and to reduce footfall, patients will not be allowed visitors and paediatric patients will only be allowed one accompanying family member. We are currently in the first stage of recovery, which is planned to last six weeks before we can address non-urgent and routine cases.

Conclusion

We have embraced the challenges faced during these uncertain times and maintained a highly effective and efficient trauma and elective service, one that we can adapt to protect our essential services should there be further peaks. This has been made possible by taking the lead in decision-making and creating pathways early in our subspecialty groups, whilst branching out and taking over key roles in more unfamiliar settings. We are now drawing on our experience over the last few months to improve the quality and efficiency of our services long term, incorporating what worked well whilst maintaining tried and tested methods, and would encourage all departments and trusts to do the same.

Declaration of Competing Interest

The authors would like to confirm that there are no conflicts of interest.

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References

1. World Heath Organisation. Coronavirus disease (COVID-2019) situation reports. 2020. https://www.who.int/emergencies/diseases/novel-coronavirus-2019/situation-reports (accessed 13 Jun 2020).
2. The Leeds Teaching Hospitals NHS Trust. About us. 2020. https://www.leedsth.nhs.uk/about-us/ (accessed 13 Jun 2020).
3. Garude K, Natalwala I, Hughes B, et al. Patterns of adult and paediatric hand trauma during the COVID-19 lockdown. *J Plast Reconstr Aesthet Surg* 2020 Published Online First. doi:10.1016/j.bjps.2020.05.087.
4. BAPRAS. Advice for managing melanoma patients during coronavirus pandemic. 2020:1–6. http://www.bapras.org.uk/docs/default-source/covid-19-docs/corona-virus-melanoma-final-version-2.pdf?sfvrsn=2(accessed 13 Jun 2020).
5. Hughes BA, Stallard J, West CC. The use of Whatsapp as a way to deliver plastic surgery teaching during the COVID-19 pandemic. *J Plast Reconstr Aesthet Surg* 2020:1–2. doi:10.1016/j.bjps.2020.05.034.