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Review

Restarting plastic surgery: Drawing on the experience of the initial COVID-19 pandemic to inform the safe resumption of services



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Summary Coronavirus disease-2019 (COVID-19) has caused an unprecedented demand on healthcare resources globally. In the light of the arrival of a novel contagious and life-threatening virus, the NHS has responded by making difficult decisions to maintain care for patients and protect staff. The response has been frequently amended following updates in the UK Government policy as scientific understanding of the virus has improved. Our Plastic Surgery practice has adapted to mitigate risk to patients by reducing face-to-face contact, downgrading emergency procedures and deferring elective surgery where possible. This has inevitably resulted in a backlog in elective surgery and outpatient appointments. An assessment of the long-term health, social and economic impact of NHS wide service reconfiguration upon patient outcomes is yet to be seen.

In this paper, we review the demonstrable early effects of service changes upon our unit and compare those to national and internationally published data. We also outline some of the considerations being made as we consider strategies to resume services in the light of the ongoing COVID-19 pandemic.

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Introduction

The 2019 novel coronavirus (2019-nCoV) outbreak is thought to have begun in Wuhan, China, in late December 2019 and was named COVID-19 by the World Health Organisation (WHO) on 11 February 2020.¹ Following the initial outbreak in China, the disease spread rapidly across the world with Italy, Spain and the United Kingdom (UK) the most severely affected countries in Europe.

The UK Government published the 'Coronavirus action plan' outlining the stepwise approach in managing the outbreak in the UK, with the 'Mitigation Phase' requiring NHS service providers to support early discharge from hospital, defer non-urgent care and triage service delivery.²

The Plastic Surgery service in Oxford responded to this unprecedented national medical emergency by reconfiguring services and patient pathways. This paper sought to compare the initial observations seen after the commencement of the UK 'lockdown' to that seen 1 year earlier. We also outline the framework upon which we will begin reinstating services for the coming 'new normal' period.

Methods

We conducted a retrospective review of plastic surgery trauma patient interactions, skin cancer surgery and breast reconstructive surgery for April 2019 and compared this data with April 2020 - the first full month following lockdown. An EMBASE (Ovid), Pubmed, Google and Cochrane Library search was subsequently conducted in June 2020 for publications related to 'COVID-19' and 'Plastic Surgery'. The British Association of Plastic, Reconstructive and Aesthetic Surgery (BAPRAS), Royal College of Surgeons of England, Office of National Statistics (ONS) and Public Health England

(PHE) websites were reviewed for information supporting healthcare providers dealing with the COVID-19 outbreak.

Results

Changes to plastic surgery in the UK

Since the beginning of the coronavirus pandemic, available intensive care unit (ICU) capacity has almost entirely been diverted to the management of COVID-19 with the knock-on effect of almost completely halting elective, general anaesthetic procedures in favour of emergency, cancer and day-case procedures. Plastic surgeons were encouraged to adopt new surgical pathways, use virtual follow up where possible and to only see urgent cases in clinics.^{3,4} Meanwhile, BAPRAS also conducted a public information campaign, warning self-isolating patients of the risks of DIY and other avoidable injuries at home.⁵

The Royal College of Surgeons of England (RCSE) identified plastic surgery procedures that could be deferred for up to 4 weeks (priority level 2), up to 3 months (priority level 3) or more than 3 months (priority level 4). The latter category included all cleft lip and palate surgery, scar contracture releases and breast reconstruction. The British Burn Association also advised that elective non-urgent cases should be postponed and burns managed non-operatively where possible. They also advised increasing the provision for day case procedures and minimising outpatient attendance with senior decision-making at the first point of contact, alongside utilising electronic photo referrals.⁶

Plastic surgery trauma

The British Orthopaedic Association and the British Society for Surgery of the Hand made COVID-19-related changes to recommendations for trauma inpatient and outpatient

management. These included access to senior advice for A&E and GP's at an early stage, non-operative management where possible and a shift towards predominantly day case/WALANT surgery.⁷

In our unit, we saw over 700 new face-to-face trauma referrals per month prior to COVID-19. We, therefore, made the following changes to minimise hospital footfall and reduce the risk to patients and clinicians:⁸

- All new referrals, from 09:00 to 17:00 were made directly to a triaging consultant working from home and from 17:00 to 08:00 to the on-call registrar.
- We used telemedicine to avoid unnecessary patient contact but still facilitate decision-making and, when appropriate, community-based care.
- Patients thought to require surgical intervention following telemedicine consults were assigned directly to a theatre list and managed on a 'see and treat' basis.
- A daily virtual paediatric clinic reviewed all referrals from the past 24 h. We then telephoned parents to provide phone advice if their child had a minor injury and only required expectant management.

A large north London teaching hospital made similar changes to mitigate the risk to patients and staff from COVID-19.⁹ They adapted their hand trauma service to a 'One Stop Hand Trauma and Therapy' clinic categorising patients based on the BSSH Hand Injury Triage App and were able to perform 95% of operations for hand trauma under WALANT¹⁰. Previously, less than 50% of their trauma cases had been conducted under local anaesthetic or a peripheral nerve block.¹¹

Breast surgery

In April 2020, the Association of Breast Surgeons published their restarting strategy in the 'new normal' to follow up from their earlier COVID-19 guidance.^{12,13} They advised that surgeons should think very carefully before they embark on immediate breast reconstruction, in particular implant reconstruction with its relatively higher levels of post-operative infection and readmission rates, adding that those requiring non-breast cancer related surgery, risk-reducing surgery and delayed breast reconstruction may need to wait for their operation.

Skin cancer surgery

The British Association of Dermatologists advised considering deferring surgery for many BCCs and some low-risk SCCs as well as wide excision for completely excised T0 and T1a melanomas. The UK plastic surgeons and dermatologists met at the end of May 2020 as part of a BAPRAS COVID-19 series of webinars and asserted the case for a paradigm shift in the management of skin cancer.¹⁴ They suggested that to limit surgery, non-invasive confocal microscopy could be used as a diagnostic tool for equivocal BCCs or for lentigo maligna. They also asserted that lentigo maligna may be better treated medically rather than surgically and that given the exceedingly low risk of local recurrence in AJCC stage 1B melanoma, we should not be performing wide local excisions in patients in the current situation, particularly those with comorbidities. They also suggested rationalising how frequently we follow up low-risk patients and whether

Table 1 Changes to hand and general plastic surgery trauma reviews following the introduction of telemedicine and electronic referral pathways (f2f = face-to-face).

	April 2019	April 2020
Hand and Plastics Injury (HAPI) clinic (f2f)	561	74
Childrens' HAPI clinic (f2f)	159	8
Telemedicine referrals (seen f2f)	-	195 (31)
Total number of referrals	720	277
Total number of patients seen f2f	720	113
Patients managed without requiring f2f review	0	164

we should limit sentinel node procedures for 1B melanomas who rarely meet the criteria for adjuvant therapy.

The impact of these changes

An estimated 28,404,603 surgical operations from all specialties globally were predicted to be cancelled or postponed during the peak 12 weeks of disruption due to COVID-19.¹⁵ It was projected that even by increasing normal surgical volume by 20%, it would take a median of 45 weeks to clear this backlog notwithstanding the extra delays associated with current operating practices, such as 'donning and doffing' in addition to deep cleaning of theatres between cases.

Trauma

Table 1 shows the redistribution of plastic surgery trauma referrals as a result of the changes made to patient pathways, with an aim to reduce hospital footfall and face-to-face contact. The total number of referrals fell 61.5% from 720 to 277, with the number of face-to-face trauma clinic reviews falling to 82 (88.6% reduction). Thirty-one of 195 telemedicine consultations were reviewed on a 'see and treat' basis so in total, only 113 trauma patients were seen face-to-face in April 2020 as compared to 720 in April 2019, which is an 83% reduction.

In total, there was a 61.5% fall in the number of patients who were referred to our plastic surgery trauma service in the first full month after lockdown. Nationally, attendance to emergency departments fell 25% in the first week after lockdown and 49% as compared to the last week in February.¹⁶

Breast surgery

Our unit is a tertiary referral service that receives referrals from Oxfordshire and surrounding counties for immediate and delayed breast reconstruction. We performed no immediate or delayed breast reconstructions between the start of lockdown (23 March 2020) and the end of May 2020. In 2019, 80 were performed and as of 1 June 2020, 31 patients were already on our waiting list for a delayed breast reconstruction with national figures in the region of 1500 patients.¹⁷

Nationally, in the most recently published national Mastectomy and Breast Reconstruction Audit, 3389 patients underwent immediate breast reconstruction over a 15-month study window.¹⁸ Furthermore, immediate breast reconstruction has significantly increased in popularity since the audit; and according to the first UK National Flap Registry report in 2019, approximately 45% of patients chose an immediate breast reconstruction following cancer resection.¹⁹

Skin cancer

There were 151,739 new cases of non-melanoma skin cancer between 2015 and 2017 in the UK, with the peak rate in those 90 years of age and above.²⁰ In our unit, we operated on 58% fewer (41) patients for suspected NMSC in the first month after lockdown as compared to the same period in 2019 (97) extrapolating nationally to 5331 cases of untreated NMSC in 3 months or 21,324 cases in 1 year. The Netherlands Cancer Registry (from 24 Feb 2020 to 12 April 2020) also showed that there was a 26% decrease in cancer diagnoses when compared with the period before the COVID-19 outbreak, most pronounced for skin cancer, which saw a 60% drop in numbers.²¹

Determining which patients are most at risk

The COVIDSurg Collaborative assessed outcomes for surgical patients who were COVID-19 positive. They found that less than one-third of patients were diagnosed prior to their surgery and nearly one quarter died within 30 days of being in theatre. Risk factors for mortality were the age of 70 years or older, male sex, poor preoperative physical health status, emergency versus elective surgery, malignant versus benign or obstetric diagnosis and more extensive (major vs minor) surgery.²² As this study was pan-speciality and included those with comorbidities, it is important not to incorrectly conclude that all surgeries are now a high risk (for comparison the NELA (UK emergency laparotomy audit) study had a similar 30-day mortality of 23.4% in frail patients over 70 years). We looked at 364 patients undergoing surgery in our unit from March to the end of April 2020 and found that less than 1% developed COVID-19 symptoms post-operatively. In addition, only 4 patients were diagnosed with confirmed COVID-19 post-op, of which the 2 patients who died were both aged over 80 years with significant comorbidities. Our results during the peak of COVID-19 in the UK suggest that with appropriate preoperative screening and intra-/peri-operative PPE, there is no clear increased risk of undergoing a plastic surgical procedure despite the findings of the COVIDSurg Collaborative study.

On 15 May 2020, the intensive care national audit and research centre (ICNARC) published their report on COVID-19 in critical care.²³ They were notified of 11,292 admissions (8699 patients) to critical care with confirmed COVID-19. Significant risk factors were male gender, black and minority ethnicity (BAME) and increasing age. When comparing the distribution of index of multiple deprivation (IMD) with confirmed COVID-19 with an age- and sex-matched local population, those in the highest IMD quintiles (4 and 5) had a 5% higher chance of developing COVID-19. The average age of patients critically ill with COVID-19 was 58.6 years with

78.3% of patients aged 50 years and above. The hazard ratio (likelihood of death from COVID-19) was 2 for patients aged 70 years when compared with aged 60 years, whereas a patient aged 40 years had a hazard ratio of approximately 0.5. Public Health England published a paper on 'Disparities in the risk and outcomes of COVID-19'²⁴ reaffirming these findings by showing that people aged 80 years or older when diagnosed with COVID-19 were seventy times more likely to die than those under 40 years. The risk of dying was also higher in men, in those living in more deprived areas and in BAME groups.

Discussion

Ensuring the safe and efficient restarting of plastic surgery will require significant ongoing adaptations to current practice as new information and treatments become available. Initially, we can use data from ICNARC and NHS England to risk stratify the population, but strategies released by surgical, anaesthetic and intensive care colleges will need constant monitoring and amending as our evidence base grows.

The changes that have been implemented to accommodate for the COVID-19 pandemic have allowed rapid innovation, including new patient pathways, the increased use of telemedicine and virtual clinics, and a wide range of webinars by world-leading experts in plastic surgery to improve training. Our new pathway for plastic surgery trauma ensured that 59.2% of referred patients were managed without needing to be seen in person, not only protecting both patients and staff from unnecessary contact that could risk transmission of COVID-19 but conserving departmental resources. The new hand trauma service at the Royal Free Hospital estimated that their conversion to predominantly WALANT surgery could reduce costs by up to 70%²⁵ and that reduced face-to-face appointments could lead to an annual saving of more than £110,000 in their department.⁹

Although virtual clinics remove the cost and inconvenience of travel and may be more cost-effective to the healthcare system, they could also be clinically less robust. An increase in conservative management may lead to an increase in the number of revision surgeries required and a potentially corresponding rise in patient dissatisfaction, operating hours and overall costs.⁶ Furthermore, although consultations could be helpful to some older people who may find it difficult to travel because of comorbidity, telemedicine raises the possibility of increased inequality of access for example to the elderly or lower socioeconomic classes.²⁶ In addition, the need for patients to be assessed and operated on by the most senior personnel to limit repeated reviews and reduce staff exposure has markedly decreased training opportunities, while reducing of departmental capacity has significantly increased waiting lists for elective procedures including cancer cases. The COVID-19 crisis has been used to shoehorn several changes to clinical practice that in other times would have been far more thoroughly evaluated. If practices such as the increased use of telemedicine continue, they should be subject to the same levels of discussion and scrutiny as would have been the case pre-COVID-19.

- **The 4 P's – Place, People, PPE, Positive tests**
- **Place:**
 - Space for donning and doffing and for distancing in rest areas.
 - Use of private facilities/NHS Nightingale hospitals
 - Use of telemedicine, 'see and treat' and WALANT
- **People:**
 - Staff (particularly anaesthetists and surgeons) to return to routine work.
 - Workforce to be enhanced to cope with COVID-19 related delays and backlog of cases.
 - Ensure all staff supported with managing stress and fatigue and training.
- **PPE:** PPE available to all staff.
- **Positive tests:**
 - Avoid major surgery if COVID-19 positive unless life/limb/sight-saving.
 - Update patients on procedure prioritisation criteria and up-to-date safety risks.

Figure 1 A summary of strategies for restarting surgery - 'the 4 Ps'.

Considering breast surgery, there is an undoubted benefit of immediate reconstruction for a sizable cohort of women, which must be mitigated with risks of operating in the current environment. As anaesthetic- and theatre-staffing capacities return to normal, the main issue relating to breast reconstruction will be COVID-19-related risks, which in a well-governanced setting can be minimised.²⁷ A BAPRAS Breast Reconstruction Working Group have published documents that have been endorsed by the Association of Breast Surgery on 'Restarting Breast Reconstruction Services'.¹⁷ These documents emphasise the importance of restarting both immediate and delayed breast reconstruction from a psychological and functional standpoint, with informed consent of patients to reflect the additional risks associated with COVID-19. All patients considered for oncoplastic breast surgery should be discussed at a combined MDT and where possible patients should undergo breast conservation surgery through oncoplastic techniques thus avoiding lengthier/repeat operations. Suggested strategies for dealing with the high backlog of cases include using the private sector, high volume/super centres or increasing the number of plastic/reconstructive surgeons.

In May 2020, The Royal College of Anaesthetists, Association of Anaesthetists, Intensive Care Society and Faculty of Intensive Care Medicine published a strategy document entitled 'Restarting planned surgery in the context of the COVID-19 pandemic'²⁸ and The Royal College of Surgeons concurrently published the 'Recovery of surgical services during and after COVID-19'.²⁹ Our interpretation of these documents and how they relate to what we have learnt from

our own experiences and the literature thus far can be summarised as the '4 Ps' (Figure 1):

- **Place:** Additional space required not only for donning and doffing but also to keep staff and patients distanced where possible. Ensuring adequate facilities may include the continued use of private healthcare in addition to NHS Nightingale hospitals. COVID-19-positive theatres should be out of high traffic areas and emptied of non-essential items. Hospital footfall should continue to be limited by the judicious use of telemedicine and 'see and treat' surgery where possible.
- **People:** Those reallocated to different roles, such as anaesthetists, ward staff and junior doctors, must return to their routine work to help with the backlog of elective cases. Clinician job plans may also need modifying to consider the need for additional theatre time in managing COVID-19-related risks, which may also require enhancing of the workforce. Local multidisciplinary recovery management teams should meet daily (virtually where possible) to make decisions on the prioritisation of patients. The workforce should be given sufficient support in areas, such as stress and fatigue management, particularly junior doctors with regard to their training.
- **PPE:** All governmental initiatives to try to limit the spread of COVID-19, such as the 15 June directive, that face masks and coverings must be worn by all NHS hospital staff and visitors at all times, must be accessible for all NHS staff along with all other necessary PPE.
- **Positive tests:** Patients should not have major surgery if COVID-19 positive except for life, limb or sight-saving

procedures. Clear communication with patients must be prioritised to update them on procedure prioritisation criteria, safety risks for receiving care in hospitals during COVID-19, post-discharge care and carrying out virtual consultations. A record should be made of deferred cases awaiting elective surgery, those on stalled care pathways and new patients. NHS England information should be analysed to plan the delivery of surgical services.

Less than 6 months ago 'R' values, 'lockdown', 'social distancing' and 'PPE' were words and phrases rarely used within our society. However, COVID-19 has likely changed the global landscape for years to come, and as healthcare providers, we must continue to learn and adapt to best care for our patients and each other. We now know that increasing age, male sex, low socioeconomic class, black and minority ethnic (BAME) background, certain comorbidities and obesity are all independent risk factors for death from COVID-19. This information, together with local and national data provided by NHS England and the NHS 'track and trace' service will make it possible to ensure patients are adequately informed regarding the extra risks posed by COVID-19. We now have surgical management strategies to use if there is a 'second wave', and also know that we can adapt if these strategies are insufficient. Until then, we must be ready to 'get back to normal' - whatever 'normal' now is.

Ethical approval

Not applicable.

Declaration of Competing Interest

None.

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None.

References

- <https://www.who.int/dg/speeches/detail/who-director-general-s-remarks-at-the-media-briefing-on-2019-ncov-on-11-february-2020> [Accessibility verified June 17, 2020]
- <https://www.gov.uk/government/publications/coronavirus-action-plan/coronavirus-action-plan-a-guide-to-what-you-can-expect-across-the-uk> [Accessibility verified June 17, 2020]
- <http://www.bapras.org.uk/professionals/About/member-resources/covid-19-advice-for-members> [Accessibility verified June 17, 2020]
- <http://www.bapras.org.uk/docs/default-source/covid-19-docs> [Accessibility verified June 17, 2020]
- <https://twitter.com/BAPRASvoice/status/1240666092604973056> [Accessibility verified June 17, 2020]
- <https://www.england.nhs.uk/coronavirus/wp-content/uploads/sites/52/2020/03/C0221-specialty-guide-surgical-prioritisation-v1.pdf> [Accessibility verified June 17, 2020]
- <http://www.bapras.org.uk/docs/default-source/covid-19-docs/final-boast-doc-badged.pdf?sfvrsn=2> [Accessibility verified June 17, 2020]
- Armstrong A, Jeevaratnam J, Murphy G. et al. A plastic surgery service response to COVID-19 in one of the largest teaching hospitals in Europe. *J Plast Reconstr Aesthet Surg* 2020;73(6):1174-205.
- Sadr MAH, Gardiner MS, Burr MN, Nikkiah MD, Jemec MB. Managing hand trauma during the COVID-19 pandemic using a one-stop clinic. *J Plast Reconstr Aesthet Surg* 2020;73(7):1357-404.
- Lalonde DH, Tang JB. How the wide awake tourniquet-free approach is changing hand surgery in most countries of the world. *Hand Clin* 2019;35 xiii-xxiv.
- Choo A, De Leo A, Jemec B. Hand trauma service: efficiency and quality improvement at the royal free NHS foundation trust, London. *Poster. BSSH Spring Meeting*; 2017.
- <https://associationofbreastsurgery.org.uk/for-members/covid-19-resources/> [Accessibility verified June 17, 2020]
- <https://associationofbreastsurgery.org.uk/media/296474/may-abs-statement-final-250520.pdf> [Accessibility verified June 17, 2020]
- <http://www.bapras.org.uk/professionals/training-and-education/bapras-events/covid-19-webinars> [Accessibility verified June 17, 2020]
- Nepogodiev D, Bhangu A. Elective surgery cancellations due to the COVID-19 pandemic: global predictive modelling to inform surgical recovery plans. *British J Surg* 2020;107(11).
- Thornton J. Covid-19: A&E visits in England fall by 25% in week after lockdown. *BMJ*, 6 Apr 2020, 369:m1401
- <http://www.bapras.org.uk/media-government/news-and-views/view/re-establishing-breast-reconstruction-services> [Accessibility verified June 17, 2020]
- <https://www.rcseng.ac.uk/-/media/files/rcs/library-and-publications/non-journal-publications/national-mastectomy-and-breast-reconstruction-audit-4th-report.pdf> [Accessibility verified June 17, 2020]
- https://www.bahno.org.uk/_userfiles/pages/files/uknfr_first_report_4dec_2019.pdf [Accessibility verified June 17, 2020]
- <https://www.cancerresearchuk.org/health-professional/cancer-statistics/statistics-by-cancer-type/non-melanoma-skin-cancer/> [Accessibility verified June 17, 2020]
- Dinmohamed AG, Visser O, Verhoeven R.H.A. et al. Fewer cancer diagnoses during the COVID-19 epidemic in the Netherlands. *Lancet Oncol*, 2020;21(6):750-751.
- Myles PS, Maswime S. Mitigating the risks of surgery during the COVID-19 pandemic. *Lancet*. 2020;6736(20):19-20.
- <https://www.icnarc.org/Our-Audit/Audits/Cmp/Reports> [Accessibility verified June 17, 2020]
- <https://www.gov.uk/government/publications/covid-19-review-of-disparities-in-risks-and-outcomes> June 2 [Accessibility verified June 17, 2020]
- Rhee PC, Fischer MM, Rhee LS, McMillan H, Johnson AE. Cost savings and patient experiences of a clinic-based, wide-awake hand surgery program at a military medical center: a critical analysis of the first 100 procedures. *J. Hand Surg.* 2017;42(3):e139-47.
- Greenhalgh T, Vijayaraghavan S, Wherton J. et al. Virtual online consultations: advantages and limitations (VOCAL) study. *BMJ Open* 2016;6(1):1-13.
- Hart A. Unshackling plastic surgery from COVID-19. *J Plast Reconstr Aesthet Surg* 2020;73(1009-1011).
- <https://www.ficm.ac.uk/news-events-education/news/restarting-planned-surgery-context-covid-19-pandemic> [Accessibility verified June 17, 2020]
- www.rcseng.ac.uk/coronavirus/recovery-of-surgical-services [Accessibility verified June 17, 2020]