The impact of COVID-19 on adult burn management in the UK: a regional centre experience

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Conflict of Interest Statement

The authors declare that there is no conflict of interest

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Authorship

All authors should have made substantial contributions to all of the following:

(1) the conception and design of the study, or acquisition of data, or analysis and interpretation of data

(2) drafting the article or revising it critically for important intellectual content

(3) final approval of the version to be submitted.

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Abstract

In this study, the authors aim to quantify the impact of COVID-19 on burns provision at an adult regional burn centre. Two cohorts of patients were identified for comparison: one during the beginning of the COVID-19 lockdown in April 2020 and a comparator cohort in April 2019. There was a 30% decrease in the incidence of adult burns in 2020. The mean total body surface area (TBSA) was 1.8% and 4.3% in 2019 and 2020, respectively. Scald injuries were the commonest mechanism of burns in both cohorts. Depth of burns were deeper in 2019, with 17.6% of patients presenting with deep burns, compared with 9.6% in 2020. 8% of patients in 2019 required theatre compared with zero patients in 2020. A similar percentage of patients were admitted in both cohorts. In 2019, admitted patients had an average inpatient stay of 0.57 days per TBSA. In 2020, the average stay per TBSA in all patients was 0.6 days and 1.5 days in survivors. In the lockdown period, 54% of patients were followed up by telemedicine. This difficult period has taught us how important a functioning healthcare system is and how we can be better prepared in the future.

Keywords

Adult burns management; COVID-19; burns surgery;

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Introduction

The 2019 novel coronavirus is classified under the betacoronavirus genera and is responsible for the global pandemic that started in the Wuhan province of China in December 2019 [1]. This new strain of coronavirus was named 'Severe Acute Respiratory Syndrome Coronavirus 2' (SARS-CoV-2) by the International Committee on Taxonomy of Viruses [2]. The World Health Organisation (WHO) labelled the resulting infection as 'Coronavirus disease 2019' (COVID-19) [3].

The first recorded case of COVID-19 was in late January 2020. At the time of writing, there have been 43,906 deaths in the United Kingdom (UK) with a total of 313,483 people testing positive for the virus, thus making the UK one of the worst hit countries in the world [4].

Acute burn injuries are serious conditions, and correct time-critical management is vital for survival. Recommendations have been published on how surgical specialties should adapt to maximise resources and minimise risk of viral transmission to both staff and patients. Outpatient clinic and elective surgical activity should be decreased, and all referrals should be appropriately triaged with emphasis given to telemedicine follow up where possible [5]. Burn services will need to adjust to accommodate these changes, as well as ensuring that their patients receive the best possible care.

In this study, the authors aim to quantify the impact of COVID-19 on burns provision amongst adult patients in our centre. We will explore the potential impact of any changes on patient outcomes. We also highlight learning points and how these can be taken forward in burns care.

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Methods

Ethics and Interests

This is a single-centre cross-sectional study of burns surgery during the COVID-19 pandemic. No formal ethical approval was required as the study used audit data. The study was registered and approved within the local trust's audit department. No identifiable patient data were kept or reported. This study required no internal or external funding. The authors have no conflicts of interests to declare.

Patient selection

We are a regional burns service catering a population of approximately 5 million people and encompass 16 emergency departments, 7 walk-in centres and 11 minor injury units. We are a U.K. Level 3 adult burns centre, with the ability to provide support for these patients at an intensive care level. Two cohorts of patients were identified for comparison. A cohort during the COVID-19 lockdown period from 1st April 2020 to April 30th 2020 and a comparator pre COVID-19 cohort from 1st April 2019 to April 30th 2019. Comparing time periods of the same month was considered the best way to reduce any possible effects of seasonal variability. We obtained the data for the study retrospectively by using the adult burn assessment and admission books which contains all the details of the patients who have been referred to the unit as well as the online hospital information system (CITO) for scanned notes.

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Inclusion/Exclusion criteria

Inclusion criteria included all patients who were referred on or after 1st April in both years, and up to and including 30th April. Those patients who were referred outside these dates were excluded. Only adult patients were included in our study and defined as being 18 years of age or older.

Statistics

Data were inputted and analysed in Microsoft Excel 2016. Two-tailed unpaired t-tests were performed to ascertain significant differences between the cohorts. A chi-square goodness of fit test was used to initially analyse the incidence of burns between the two time periods.

Results

(i) Demographics

There is no measurable variability in the main patient demographics between the two years as the cohorts are nearly identical for age and gender. In both time periods, the mean patient age is 43 years and the male to female ratio is approximately 3:2.

(ii) Incidence

A total of 74 patients were seen in the April 2019 period and 12 of whom were admitted. 52 patients were seen in the April 2020 period and 8 of whom were admitted. This represents a statistically significant difference in the observed number of patients within the COVID cohort when compared to the expected numbers ($p=0.99$). Further analysis of the mean values of each cohort reveals a

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significant 30% decrease ($p < 0.05$) in the number of adult burns presenting to our department or being admitted in the COVID-19 lockdown period when compared to a similar time period in 2019.

(iii) Burn presentation

Figure 1 displays the affected total body surface area (TBSA) caused by burn injuries in the two cohorts. The data suggests a shift towards burns involving a larger TBSA at the start of the UK COVID-19 lockdown when compared to April 2019. The mean TBSA in 2020 was 4.3% and this was significantly higher than the 2019 value of 1.9% ($p < 0.05$). A larger proportion of patients presenting during the COVID-19 period had burns greater than or equal to 5% of the TBSA (29% of patients) compared to the pre-COVID cohort (6.8% of patients in 2019). Both cohorts contain two major resuscitation patients each. In the 2019 cohort, the two patients had a TBSA of 15% whilst the TBSA involved of the April 2020 cases was much greater at 33% and 50% (largest TBSA burns in the entire dataset).

Figure 2 summarises the different types of burns seen in April 2019 and April 2020 as a proportion of the respective monthly total. There have been minor changes in the mechanisms leading to burn injuries when the two time intervals are compared. Scalds remain the commonest mechanism of injury during the COVID-19 timeframe despite a 12% decrease in numbers treated. Contact burns had a 14% increase in numbers referred to the burn team in April 2020 and form the second most frequent group in this time category. Other burn types such as chemical burns and flame/flash burns decreased during the lockdown period by 50% and 58% respectively. In 2019, 50% of chemical burns happened in the workplace compared with domestic causes and this number decreased to 25% in 2020. No electrical burns were recorded during the April 2020 time period.

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Figure 3 summarises the comparison between the depth of burns in the two cohorts in 2019 and 2020. Overall, the burns were deeper in the 2019 patients compared with 2020 patients. 17.6% of patients had either deep dermal (DD), full thickness (FT) or mixed depth (DD and FT) burns in 2019, compared with 9.6% of patients in 2020. 82.4% of patients in 2019 had burns which were either superficial partial thickness (SPT) or mixed depth (SPT and DD). 90.4% of patients in 2020 had burns which were either SPT or mixed depth (SPT and DD).

(iv) Initial assessment

In April 2019, all patients were seen at their local emergency department and referred to the regional burns centre on the day of injury. In April 2020, a delay in presentation is seen. The mean number of days taken by patients to present to primary care is two days after the date of injury (range between 0-22 days).

In April 2019, the policy was that all patients referred to the burns unit would attend for a face to face assessment with the burns team. All referrals were made via telephone, and this was before telemedicine was implemented in the department. However, this policy had to be adapted during COVID-19. During the April 2020 time period, all referrals (outside the base hospital) were done via telemedicine and were discussed in the morning multidisciplinary team (MDT) meeting. A decision was made about whether patients would need to attend the unit for a face to face appointment, whether patients were suitable for the outreach service or whether they were suitable for further telemedicine follow up. In the COVID-19 cohort of patients, 48% attended the unit for a face to face assessment of their burn, 14% were identified as suitable candidates for outreach services and 38% of patients were consulted via telemedicine.

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(v) Treatment

In the cohort from April 2019, 85% of patients were managed with simple dressings and analgesia compared with 92% of patients being managed in a similar way in April 2020. One patient in both cohorts had a severe chemical burn that required irrigation with Diphoterine®

and regular pH monitoring. Similarly, there were two patients in both groups who required intravenous fluid resuscitation as they were categorised as major burns of 15% TBSA and over. In 2019, 8% of patients required debridement in theatre along with a split thickness autograft and a further 3% required enzymatic debridement with NexoBrid™. In 2019, the mean number of days for a patient to be taken to theatre for autograft was 20 days (Range 4 – 60). All FT burns assessed to be entirely FT at presentation were excised within 72 hours in optimised patients. In 2020, zero patients underwent debridement with split thickness autograft in theatre. One patient who presented as a 33% TBSA burn underwent enzymatic debridement with NexoBrid™ on the intensive care unit.

(vi) Management

After initial assessment, the admission rates are similar between the two cohorts – 16% of patients were admitted in 2019 compared with 15% of patients in 2020. For survivors, the mean number of days admitted to the ward in 2019 was 5 days (range 1-16 days) and in 2020, a mean of 11 days admission is seen (range from 2-22 days). Accounting for the underlying clinical differences, the data can be standardised to calculate the average inpatient length of stay per 1% TBSA burn. The average stay per 1% TBSA burn was 3.8 days in 2019 and 1.7 days in 2020. The apparent halving in the length of stay per percent burn was not significant ($p>0.05$).

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28% of patients were discharged to their general practitioner (GP) or district nurse for dressing management in 2019 but all patients were followed up by the burns team in 2020. 53% of patients attended the burns unit in 2019 for regular face to face appointments with the team for dressing changes and review compared with only 21% of patients in 2020. 10% of patients were followed up by the outreach team during the COVID-19 lockdown period and a further 54% were followed up through telemedicine and uploading regular photos for review by the burns MDT. Table 1 (below) displays a summary of the different management options and outcome for patients in 2019 and 2020.

Discussion

We are regularly audited as a regional burns centre, providing data to the International Burn Injury Database (IBID), and our pre COVID-19 data are comparable to national figures. However, there is little published literature on how the novel 2019 coronavirus has impacted burns services in the U.K. or worldwide. The total number of attendances to national emergency departments in April 2020 was 917,000, a decrease of 56.6% compared to the same month in 2019 [6]. This is consistent with our results which show a significant 30% decrease in the incidence of burn injuries presenting to our centre between the two periods. Similar patterns in burn epidemiology have also been observed elsewhere in the UK, such as in Birmingham [7]. Our results also show that whilst all patients presented to A&E on the date of injury in the pre-COVID era, patients in April 2020 tended to present 2 days later on average to the hospital with their burn injury. We hypothesise that patients are less likely to seek immediate medical help during the early COVID-19 lockdown period due to their fears of disease transmission, and this may have been further influenced by the public health advice to avoid attending hospitals unless deemed an absolute emergency.

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The British Burn Association (BBA) published a poster at the beginning of lockdown on how to avoid injury while self-isolating [8]. Whilst this could explain the reduction in overall numbers, our data indicates a trend towards burns with a greater TBSA involvement during the latter time period and also a rise in fatalities, though this may not be causal. There were two deaths in 2020. One burn was a 50% TBSA scald burn due to excessive drinking whilst in self isolation and falling asleep in a hot bathtub. This patient also contracted COVID-19 during their inpatient stay and at this time in the UK, inpatient testing was only performed on those patients with a fever or symptoms [9]. Testing of asymptomatic inpatients was put in place by the government in mid-May. This patient was not symptomatic on admission and unfortunately did not show symptoms until late in disease progression. The other burn was a 33% TBSA burn due to a 'do-it-yourself' welding injury and the cause for mortality was due to a large upper gastrointestinal bleed.

Our results also show that scald and contact burn injuries form the most common type of injury mechanisms in April 2020. Contact burns were the only type to increase during the lockdown, rising by 14% when compared to April 2019. A possible explanation is that scald and contact burns tend to be caused by kettles and cooking, which keeps with the idea that these are more likely when people are spending more time at home. Further evidence to support our hypothesis has been the proportional decrease in burns more commonly related to the workplace such as chemical burns (e.g. cement burns).

Telemedicine has revolutionised the way burns services work amidst this global healthcare crisis as patients preferentially seek non-face-to-face treatment. In 2020, there was the introduction of the online telemedicine system, MDSAS, in which electronic referrals and follow up appointments are made. MDSAS has allowed patients to regularly upload photographs using a QR code on their smart

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phone and has allowed the burns MDT to review their progress on a regular basis. For this purpose, we instituted a daily MDT meeting in the morning rather than twice weekly to factor in all new referrals. The result was that all 2020 cohort patients were followed up by the burns clinical team compared with 72% of patients in 2019. We also expanded the reach and scope of our outreach service to help cope with the increasing pressures of the pandemic, with all members of the MDT taking part. Other burn centres in the UK have adopted a similar strategy. For example, in Birmingham, minor burns with <10% TBSA are not routinely admitted and telemedicine is used to monitor progress of patients in a "virtual" burn wound clinic [9].

The average length of stay (LOS) in hospital per 1% TBSA burn in survivors decreased in 2020 from 3.8 days/TBSA to 1.7 days/TBSA however the difference is not significant. This is thought to reflect the discharge policy which aimed to reduce inpatient stay during the height of the pandemic. Length of stay in a burn injury patient is affected by severity of the injury, comorbidities, socio-economic status as well as complications encountered whilst in hospital [10-12]. To reduce the risk of transmission of COVID-19 and reserve resources, it is sensible to reduce the length of inpatient stay [13]. At our centre, patients were only discharged once their pain and dressings were manageable, and every effort was made to maintain the burns unit as a COVID free area.

Although not proven, the powered dermatome used to harvest a split thickness autograft is thought to be an aerosol generating procedure and so, its use may increase the risk of transmission of the virus in theatre [14]. However, the national guidelines in the UK deemed emergency burns surgery to be essential during the COVID-19 period [15]. Our burns centre had full access to theatre space and utilised it as we needed. That considered, zero patients were taken to theatre for surgical debridement and split thickness autograft during the April 2020 period. There were two patients

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identified in the 2020 cohort that had deeper burns (either FT or mixed depth DD/FT) and were treated non-operatively due to poor performance status. Both patients were managed by outreach services with dressings and followed up at the daily MDT. One patient presenting in April 2020 with a life-threatening burn, underwent enzymatic debridement on the intensive care unit using NexoBrid™. This was felt to be the safest course of action at the time. NexoBrid™ is a suitable alternative and has been proven to significantly reduce the utilisation of burn surgery and is currently the non-surgical burn debridement option with the highest level of evidence globally [16].

Although we highlight key points, a major limitation is that this is a single centre study with a relatively small sample size. Data for the COVID-19 cohort were also collected from a snapshot time period at the beginning of the national lockdown and therefore may not be representative of burns care later in the lockdown period.

However, it is important to note that adapting our regional management of burns patients using the COVID-19 appropriate measures happened quickly and smoothly at our institution. Furthermore, we did not find any major adverse event impacting the patients.

Conclusion

All surgical services have had to adapt to the COVID-19 healthcare crisis. This difficult period has not only taught us how important a functioning healthcare system is but also how we can learn from this pandemic and be prepared in the future.

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Table 1: Table summarising the treatment and management of burns patients in April 2019 and April 2020.

	April 2019 (n(%))	**April 2020 (n(%))**
a) Treatment		
i. Dressings and analgesia	63 (85)	48 (92)
ii. pH monitoring and irrigation	1 (1)	1 (2)
iii. Intravenous fluid resuscitation	2 (3)	2 (4)
iv. Debridement and split thickness autograft in theatre	6 (8)	0 (0)
v. Enzymatic debridement (NexoBrid™)	2 (3)	1 (2)
b) Management		
i. Admission	12 (16)	8 (15)
ii. Discharged to general practitioner/district nurse	21 (28)	0 (0)
iii. Regular face to face assessments	39 (53)	11 (21)

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iv.	Scar clinic follow up	2 (3)	0 (0)
v.	Outreach service	0 (0)	5 (10)
vi.	Telemedicine	0 (0)	28 (54)

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Figure Legends

Figure 1: Bar-chart comparing the total body surface area (TBSA) affected by burn injuries presenting in April 2019 and April 2020. In 2020, a shift to the right along the x axis is noted within the data. This indicates that burns in 2020 tended to have a greater TBSA involvement on average.

Figure 2: Pie-charts depicting mechanism of burn injury in the two cohorts. Scald injuries are the leading cause of burns in both cohorts and form a larger proportion of the April 2020 burns. Contact burns are the second most common cause of injury during the COVID-19 timeframe and have almost doubled in frequency.

Figure 3: Bar-chart comparing burn depth in patients presenting in April 2019 and April 2020. The x axis indicates the depth of burns: superficial partial thickness (SPT), deep dermal (DD), full thickness (FT) or mixed depth (either SPT/DD or DD/FT). The y axis represents the percentage of the total number of burns that presented with a certain burn depth.

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Figure 1

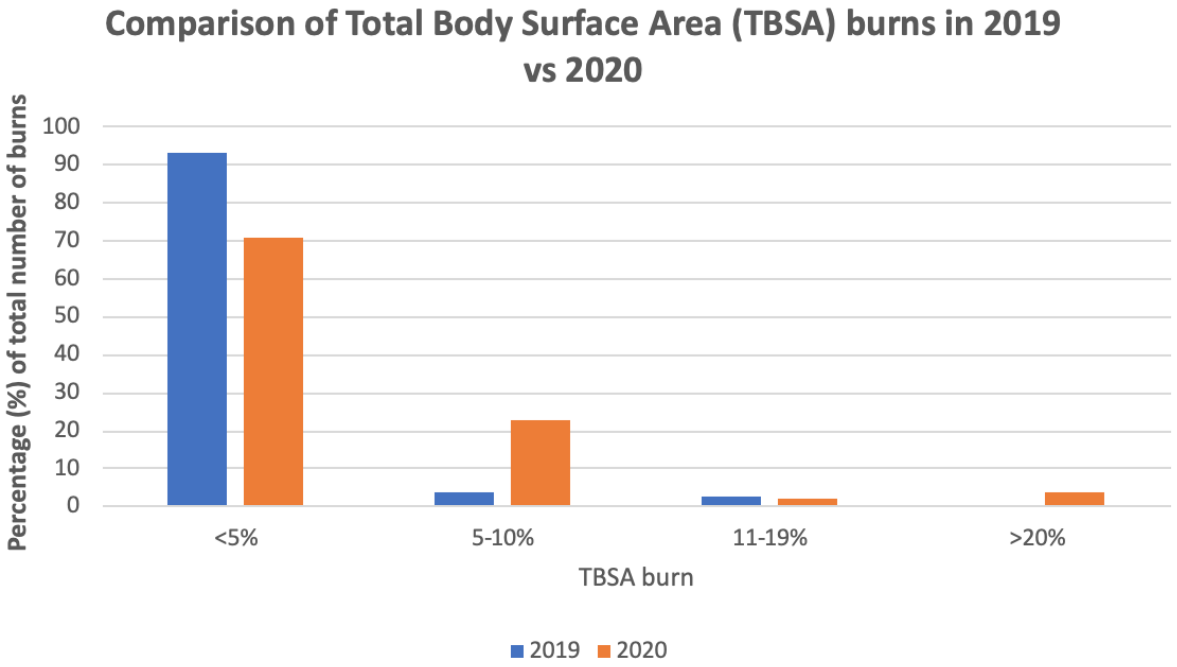
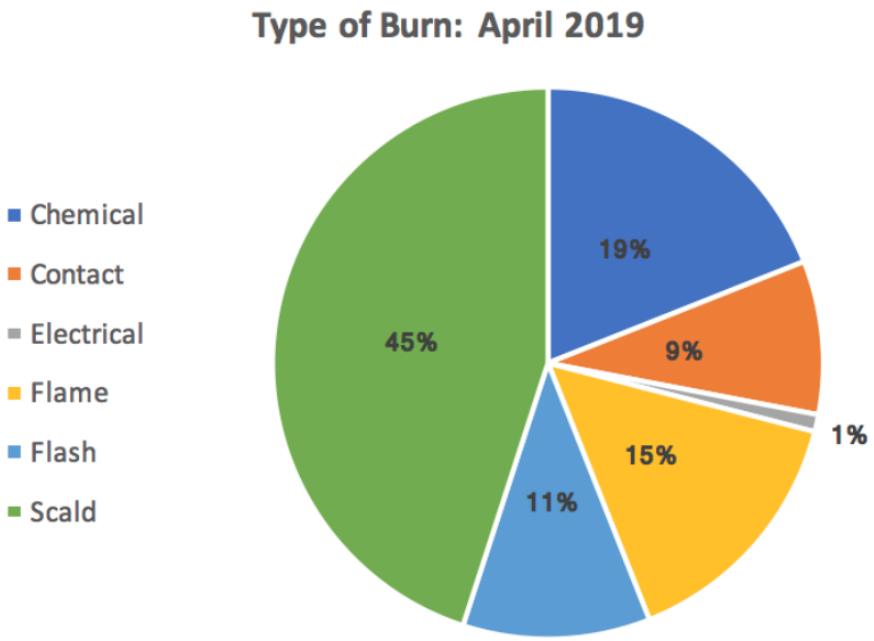

Comparison of Total Body Surface Area (TBSA) burns in 2019 vs 2020
Percentage (%) of total number of burns
100
90
80
70
60
50
40
30
20
10
0
<5%
5-10%
11-19%
>20%
TBSA burn
2019
2020

Figure 2


Type of Burn: April 2019
Chemical
Contact
Electrical
Flame
Flash
Scald
19%
9%
1%
15%
11%
45%

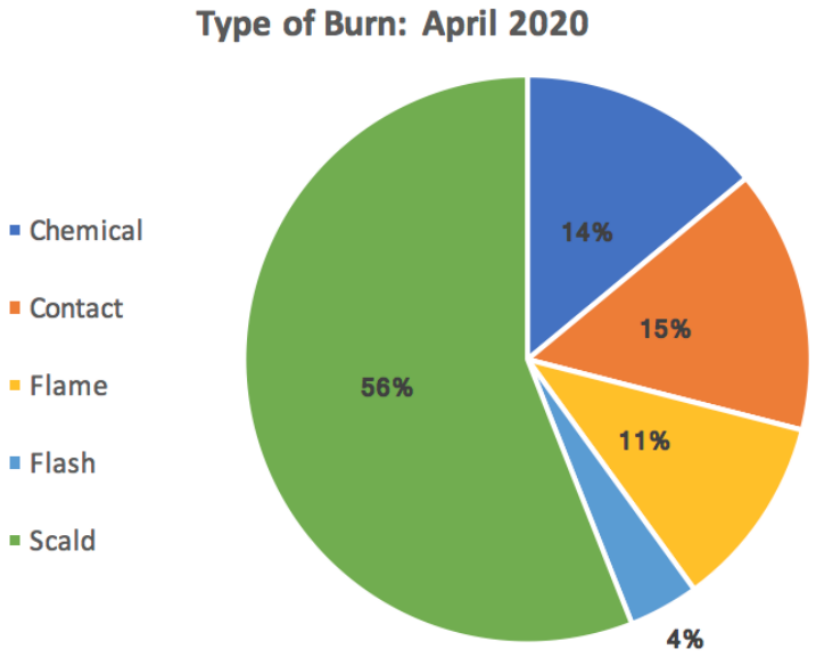
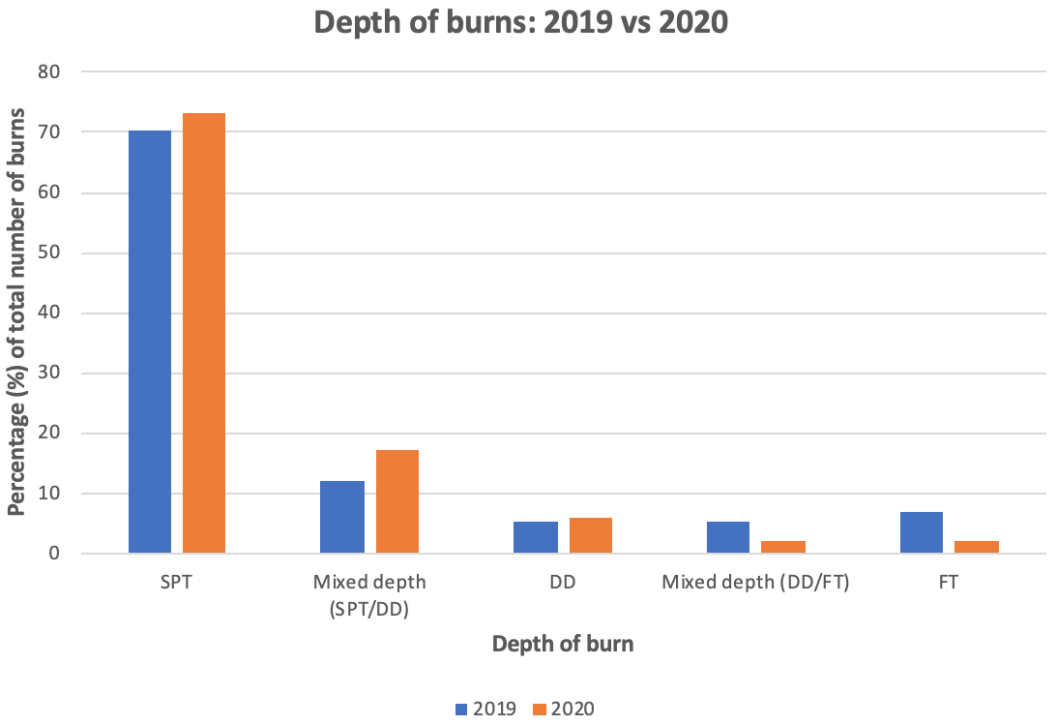

Type of Burn: April 2020
Chemical
Contact
Flame
Flash
Scald
14%
15%
11%
4%
56%

Figure 3


Depth of burns: 2019 vs 2020
Percentage (%) of total number of burns
80
70
60
50
40
30
20
10
0
SPT
Mixed depth (SPT/DD)
DD
Mixed depth (DD/FT)
FT
Depth of burn
2019
2020