

Emergency Vitrectomies for Retinal Detachment Before and During the Coronavirus Pandemic – A Retrospective Single Centre Analysis

Notfallmäßig durchgeführte Vitrektomien zur Behandlung von Netzhautablösungen vor und während der Coronaviruspandemie – eine retrospektive Analyse eines einzelnen Zentrums



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ABSTRACT

Background While the corona pandemic and the resulting containment measures affect the number of elective surgical procedures, the impact on emergency surgical interventions is less tangible. This analysis quantifies the frequency of emergency vitrectomies for retinal detachment and investigates underlying factors.

Methods Retrospective identification of patients who underwent primary emergency vitrectomies for retinal detachment at the Cantonal Hospital of Lucerne between 01.01.2018–31.12.2020. Parameters were collected, including demographics, date of hospitalisation, reported onset of symptoms, pre-operative best corrected visual acuity (BCVA), involvement of the macula, and canton of residence.

Results Overall, a total of 665 patients with 683 eyes underwent emergency surgery for primary retinal detachment in the time span of 01.01.2018–31.12.2020. Median monthly number of surgeries was 20. During the first Swiss national lockdown (16.03.2020–19.04.2020), a minimum of 9 vitrectomies was recorded in March 2020. A maximum of 36 vitrectomies was conducted in August 2020. The mean age of patients was 61.5 years. Of the 665 patients, 133 (20.0%) were residents of the canton of Ticino. Median pre-operative BCVA was 0.25 over all three years, and no significant reduction in pre-operative BCVA was observed during or after the lockdown. The proportion of eyes with involvement of the macula was 52.2%. In 2018, this proportion (47.6%) was significantly lower than in 2019 and 2020 (Chi² test, $p < 0.001$). However, cases with macular involvement in post lockdown months were not more frequent. Median time in days from reported symptom onset to hospitalisation was 5 days. In April 2020, the proportion of patients with > 14 days symptom duration was significantly higher (Chi² test, $p < 0.001$). During the lockdown, there was a significant reduction in cases from Ticino. Also, patients from Ticino showed proportionally longer symptom duration after the lockdown.

Conclusion A significant reduction in the number of emergency vitrectomies was observed for the initial period of the coronavirus pandemic. Delayed emergency presentation is not assumed, since there was no increase in severity (i.e. macular involvement) or prolonged symptoms in the months following the lockdown. More protracted symptoms were only observed in patients from Ticino. The initial low numbers were generally made good later in the year.

ZUSAMMENFASSUNG

Hintergrund Während die Coronapandemie und die angewandten Eindämmungsmaßnahmen die Anzahl der elektiven chirurgischen Eingriffe beeinflussen, sind die Auswirkungen auf notfallchirurgische Eingriffe weniger greifbar. Um die Anzahl der Notfallvitrektomien bei Netzhautablösung zu quantifizieren und zugrunde liegende Einflussfaktoren zu untersuchen, wurde diese Analyse durchgeführt.

Patienten und Methoden Es wurde eine retrospektive Datenerhebung durchgeführt, um Patienten zu identifizieren, die sich zwischen dem 01.01.2018 und dem 31.12.2020 wegen Netzhautablösung einer Notfallvitrektomie am Kantonsspital Luzern unterzogen. Demografische Informationen, das Datum des Spitaleintritts, Symptombeginn, der präoperative bestkorrigierte Dezimalvisus (BCVA), die Makulabeteiligung sowie der Wohnkanton wurden erhoben.

Ergebnisse Im Zeitraum von Januar 2018 bis Dezember 2020 wurden insgesamt 665 Patienten mit 683 Augen wegen einer Netzhautablösung notfallmäßig operiert: 227 (33,2%) im Jahr 2018, 231 (33,8%) im Jahr 2019 und 225 (33,0%) im Jahr 2020. Die mediane Anzahl der Notfalloperationen pro Monat betrug 20. Ein Minimum von 9 Vitrektomien wurde im Monat

März 2020 während des ersten nationalen Lockdowns in der Schweiz (16.03.2020–19.04.2020) erreicht, dies dicht gefolgt von 10 Vitrektomien im Monat Dezember 2018. Im August 2020 wurden maximal 36 Notfallvitrektomien durchgeführt. Das Durchschnittsalter der Patienten lag bei 61,5 Jahren. 133 Patienten (20,0%) waren im Kanton Tessin wohnhaft. Der mediane präoperative BCVA lag über alle 3 Jahre bei 0,25, eine signifikante Reduktion desselben wurde weder während noch nach dem Lockdown beobachtet. Der Anteil der Augen mit Makulabeteiligung lag im Durchschnitt über die 3 Jahre bei 52,2%. Die Proportion von Fällen mit Makulabeteiligung blieb in den Folgemonaten zum Lockdown vergleichbar. Die mediane Zeitdauer in Tagen vom anamnestic berichteten Symptombeginn bis zum Spitaleintritt betrug 5 Tage. Im Februar und April 2020 wurden im Vergleich zu den restlichen Monaten des Jahres 2020 signifikant mehr Fälle mit einer Symptombdauer von > 14 Tagen verzeichnet (Chi²-Test, $p < 0,001$). Während des Lockdowns gab es signifikant weniger Fälle aus Tessin. Danach kam es proportional zu einem Anstieg von Patienten mit längerer Symptombdauer aus Tessin.

Schlussfolgerung Im Gegensatz zu publizierten Untersuchungen wurden für den Beginn der Pandemie signifikant weniger Netzhautablösungen, welche einen Notfalleingriff benötigten, beobachtet. Da in den Folgemonaten keine Zunahme von Fällen mit schweren Verläufen (z. B. mit Makulabeteiligung) oder längerer Symptombdauer zu beobachten war, wird eine zeitlich verzögerte Vorstellung nicht als Grund für die tieferen Zahlen angenommen. Alleine bei Patienten aus Tessin zeigte sich eine längere Symptombdauer. Insgesamt wurden im Laufe des Jahres die „ausgebliebenen“ Eingriffe wieder aufgeholt.

Background

Undoubtedly the coronavirus pandemic has caused an enormous number of deaths and continues to pose an imminent direct threat. Furthermore, it is having a substantial impact on diverse levels of society, including general health care [1–4].

Since the beginning of the pandemic ophthalmological practice has relevantly changed [5–7]. Compared to other medical disciplines there is a relatively high occupational hazard in contracting the virus due to the close proximity to the patient's upper respiratory tract during slit lamp examination [8,9]. Accordingly, ophthalmologists, along with emergency physicians and anaesthesiologists, are the three subspecialists who have the highest risk of COVID-19 among all physicians [10–12]. Consequently, numerous measures and prevention mechanisms have been proposed and introduced to clinical practice [13–16]. Another aspect of COVID-19's effect on ophthalmological practice is furthermore its influence on ophthalmological training emphasizing the importance of digitalization in health care [17].

Regarding surgical interventions the Swiss Society of Ophthalmology (SOG) published management guidelines for ophthalmology services in the initial phase of the pandemic, which were in

line with the American Academy of Ophthalmology (AAO) and the Royal College of Ophthalmologists [18–20]. These guidelines help in the prioritization of cases with at high risk of rapid significant and irreversible visual loss. Accordingly, a retinal detachment bares this high risk and should continue to be treated surgically with the highest priority. For other retinal conditions new ethical strategies or triage systems have been implemented immediately after the COVID-19 lockdown [21,22]. Moreover, COVID-19's impact on different eye cares and the severe consequences of a delay in treatment of sight-threatening conditions has been described by the EUROCOVCAT group [9,23,24].

One of these most sight-threatening ophthalmological conditions is retinal detachment, defined as the separation of the neurosensory retina from the underlying retinal pigment epithelium (RPE). The most common form of retinal detachment is rhegmatogenous retinal detachment (RRD), where a retinal "break" leads to penetration of fluid from the vitreous to the subretinal space. Men are more often affected than women and the age of patients at peak prevalence is between 60 to 70 years. Studies from Europe, the US and New Zealand found that non-traumatic retinal detachment occurred in about 6 to 18 in 100'000 people a year. The prognosis of retinal detachment depends on whether the

► **Table 1** Characteristics of eyes at first emergency vitrectomy (n = 683).

Year	Eyes	Monthly emergency surgeries	Right eyes	Pre-operative BCVA (decimal)	Macula off	Symptom duration (days)
	n (% of total)	Mean, Median (Range)	n (% of total)	Mean, Median (Range)	n (% of total)	Mean, Median (Range)
2018–2020	683	20.30, 20 (9–36)	386 (56.5%)	0.4217, 0.25 (0–1.6)	357 (52.2%)	10.88, 5 (0–182)
2018	227 (33.2%)	20.06, 21 (10–26)	128 (56.4%)	0.4844, 0.40 (0–1.6)	108 (47.6%)	11.27, 5 (0–130)
2019	231 (33.8%)	19.84, 20 (12–23)	129 (55.8%)	0.3437, 0.16 (0–1.6)	129 (55.8%)	10.74, 5 (0–182)
2020	225 (33.0%)	21.03, 19 (9–36)	129 (57.3%)	0.4392, 0.32 (0–1.6)	120 (53.3%)	10.62, 4 (0–119)

fovea is still attached, if this is not the case (“macula off”) it is worse. Overall, about 95% of people have anatomically successful repair of their retinal detachment. The most effective procedure for the treatment of RRD being pars plana vitrectomy (PPV) [25–28]. A known and so far irreversible complication of delayed surgical treatment of retinal detachment is proliferative vitreoretinopathy (PVR), which is thought to be triggered by a combination of retinal ischemia, inflammation and cell proliferation leading to the formation of tractional membranes and fibrosis [29–33].

The purpose of this publication is to provide a better understanding of the impact of COVID-19 pandemic on the emergency care of patients with retinal detachment in a tertiary care eye clinic. Particularly during the time period of the first national lockdown (16.03.2020–19.04.2020), retinal surgeons noted a reduction not only of elective interventions but also of emergency surgeries. Also, a clear regional disparity in the severity of affection and the number of COVID-19 cases was observed. According to the report of the Federal Office of Statistics of late April 2020, the incidence of COVID-19 cases in the canton of Ticino, where the first cases were detected, was 893 per 100'000, compared to 166 in central Switzerland [34]. As a consequence, much stricter containment measures were enforced in more severely affected regions.

In order to quantify the general observation made by surgeons, as well as to further investigate reasons for such a reduction of emergency interventions, the following detailed questions were posed: (1) Was there a reduction of patients from the relevantly more severely affected canton of Ticino during the lockdown? (2) What were the proportions of cases with macular involvement? (3) Was there a change in the length of time between the reported onset of symptoms and hospitalisation?

Methods

With the aim of identifying primary emergency vitrectomies for retinal detachment performed between the 1st of January 2018 to the 31st of December 2020 at the Eye Clinic of the Cantonal Hospital of Lucerne, a retrospective data collection was conducted: Through a search in the clinic's case record patients who had undergone vitrectomy with the application of perfluorocarbon were identified. The application of the latter is the standard procedure for retinal detachment in Lucerne, other types of interventions, e.g. cerclages were not searched nor were cases treated

with other surgical methods included as a consequence. Then, every case was evaluated singularly and only included into the analysis if the surgical intervention had been a primary emergency procedure. Consecutively, the following parameters were collected from the electronic patients' database (Eye Clinic Manager [35]): demographical information such as Patients' age at the time of primary emergency vitrectomy for retinal detachment, affected eye, sex and whether the Patients' residence was in the Canton of Ticino, were gathered. Furthermore, the reported approximate date of symptoms' onset, as well as the date of hospitalization and of the operation were registered. Lastly, clinical parameters such as the pre-operative best corrected decimal visual acuity (BCVA) and whether there was macular involvement were collected. Macular involvement was assessed by checking the surgical report of every conducted vitrectomy. A descriptive data analysis was performed in R (<https://www.R-project.org/>; version 4.0.2 [2020–06–22]). Categorical parameters were compared via Chi² test and Mann-Whitney tests were conducted to analyse numeric variables, a significance level of $p = 0.05$ was chosen.

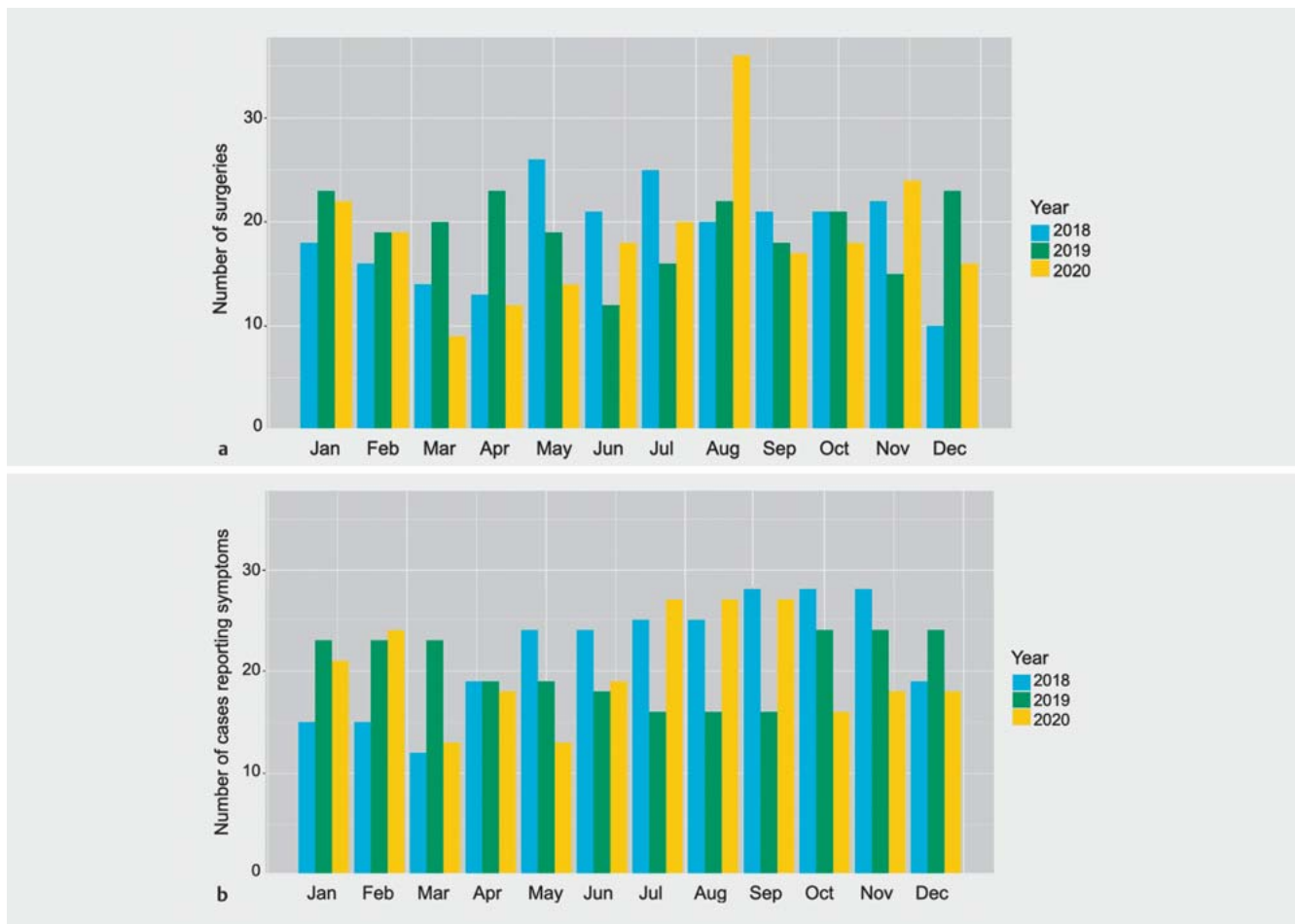
Results

A total of 683 primary emergency vitrectomies for retinal detachment were performed in the timespan of January 2018 and December 2020; 227 (33.2%) in 2018, 231 (33.8%) in 2019 and 225 (33.0%) in 2020 (► **Table 1**). Overall, these 683 interventions were conducted on a total of 665 patients. Accordingly, 18 (2.7%) patients were affected in both eyes requiring emergency operations during the three years of observation.

The proportion of female patients account for about a third (29.6%) of the total number of 665 patients; the female proportions range from 28.5% in 2019 to 30.4% in 2018, with no significant difference between the years (► **Table 2**). Mean age of patients presenting themselves at novel and primary retinal detachment was 61.5 years (Mdn = 61.5 y) and was comparable over the three years (► **Table 2**). Regarding the age distributions in the two sex groups per year, the mean age of women in the year of 2020 (Mn = 59.0 y) who underwent vitrectomy for the first time was significantly lower compared to the previous years (2018: Mn = 63.0 y, and 2019: Mn = 64.1 y) (Mann-Whitney test for 2018 vs. 2020: $p = 0.053$; for 2019 vs. 2020: $p = 0.015$).

► **Table 2** Patients' demographics (n = 665).

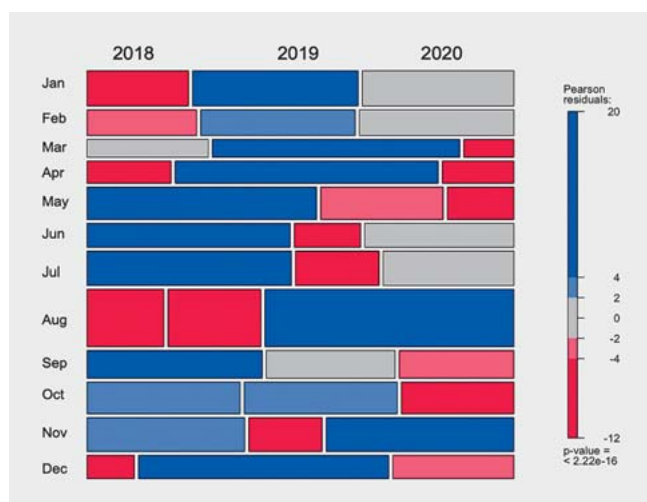
Year	Patients	Women	From Ticino	Age
	n (% of total)	n (% of total)	n (% of total)	Mean, Median (Range)
2018–2020	665	197 (29.6%)	133 (20.0%)	61.5, 61.5 (11.0–91.9)
2018	224 (33.7%)	68 (30.4%)	37 (16.5%)	62.1, 62.3 (21.1–91.9)
2019	228 (34.3%)	65 (28.5%)	58 (25.4%)	61.1, 62.0 (13.0–89.0)
2020	213 (32.0%)	64 (30.0%)	38 (17.8%)	61.1, 59.8 (11.0–88.4)



► **Fig. 1** Histograms showing counts per month and year of patients with first retinal detachment on respective eyes (n = 683). **a** Taking in consideration the date of the respective emergency vitrectomy (n = 683). **b** Considering reported date of symptom onset (n = 620).

The median number of surgeries per month over the three years of observation was 20. A minimum amount of 9 emergency interventions was observed in the months of March 2020, this was closely followed by 10 vitrectomies in the month of December 2018, as well as April 2020 with 12 vitrectomies, respectively. Whereas a maximum of 36 emergency vitrectomies was conducted in August 2020. The median number of surgeries per month ranged from 19 in 2020 to 21 in 2018, with no significant difference between the three years. ► **Fig. 1 a** depicts the absolute counts of all primary surgeries (n = 683) per month for each year.

Comparisons of the amounts of monthly emergency vitrectomies for the three years 2018, 2019 and 2020 are shown in ► **Fig. 2**. It is easily observable, that significantly fewer emergency operations were performed in March to May 2020. Numerically more operations were performed in August 2020 than in the months of August of the previous two years combined. Also, in the summer months (May to August) of 2019 significantly less surgeries were conducted compared to the other two years. In summary, the total number of operations per year is comparable but when looking at the monthly distributions and comparing those between years



► **Fig. 2** Mosaic plot showing monthly (1–12) and yearly distributions of the first emergency vitrectomies (n = 683). Squares coloured in blue represent specific months with significantly more cases compared to the same months of the other two years. All red coloured fields represent months with significantly lower counts.

there is some variability. Overall, less emergency vitrectomies were conducted during the first Swiss national lockdown (16.03.2020–19.04.2020).

When considering the reported dates of symptom onset, which were available of 620 cases, it can be observed that the number of new retinal detachments were lower for the months of March through May and increased in the summer months both for the years of 2018 and 2020 (► **Fig. 1 b**).

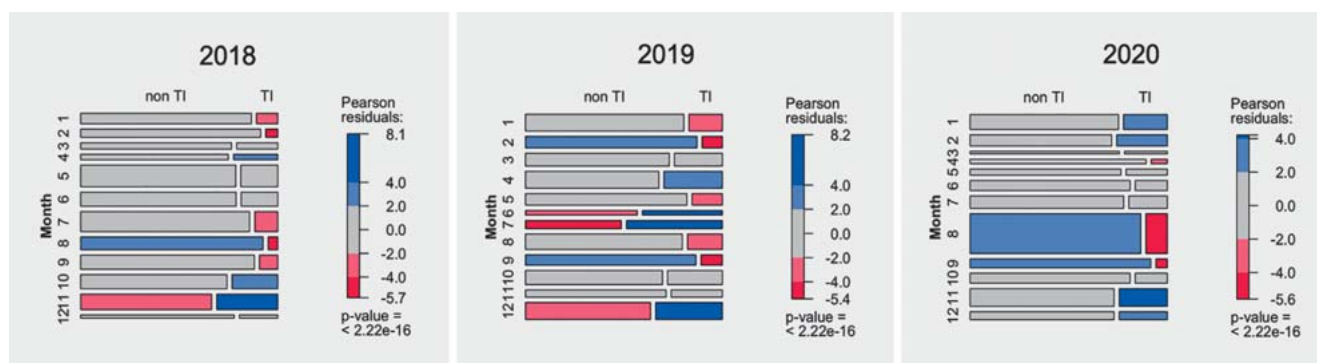
Of the 665 patients, 133 (20.0%) are residents of the canton of Ticino. In 2019, the proportion of patients from Ticino (n = 58, 25.4%) was significantly higher compared to 2018 and 2020 (Chi² test, p < 0.001) (► **Table 2**). Analysis of the monthly proportions of patients from Ticino revealed significantly lower numbers for the month of April 2020 (► **Fig. 3**). Furthermore, ► **Fig. 3** shows that generally in all three years fewer residents from Ticino were treated in Lucerne in the months of August and September.

In ► **Table 1** specifications on the 683 eyes are listed: In total, the amount of right eyes (n = 386, 56.5%) was slightly higher than that of left eyes. This was similar over all three years of observation and ranged very narrowly between 55.8% in 2019 to 57.3% in 2020.

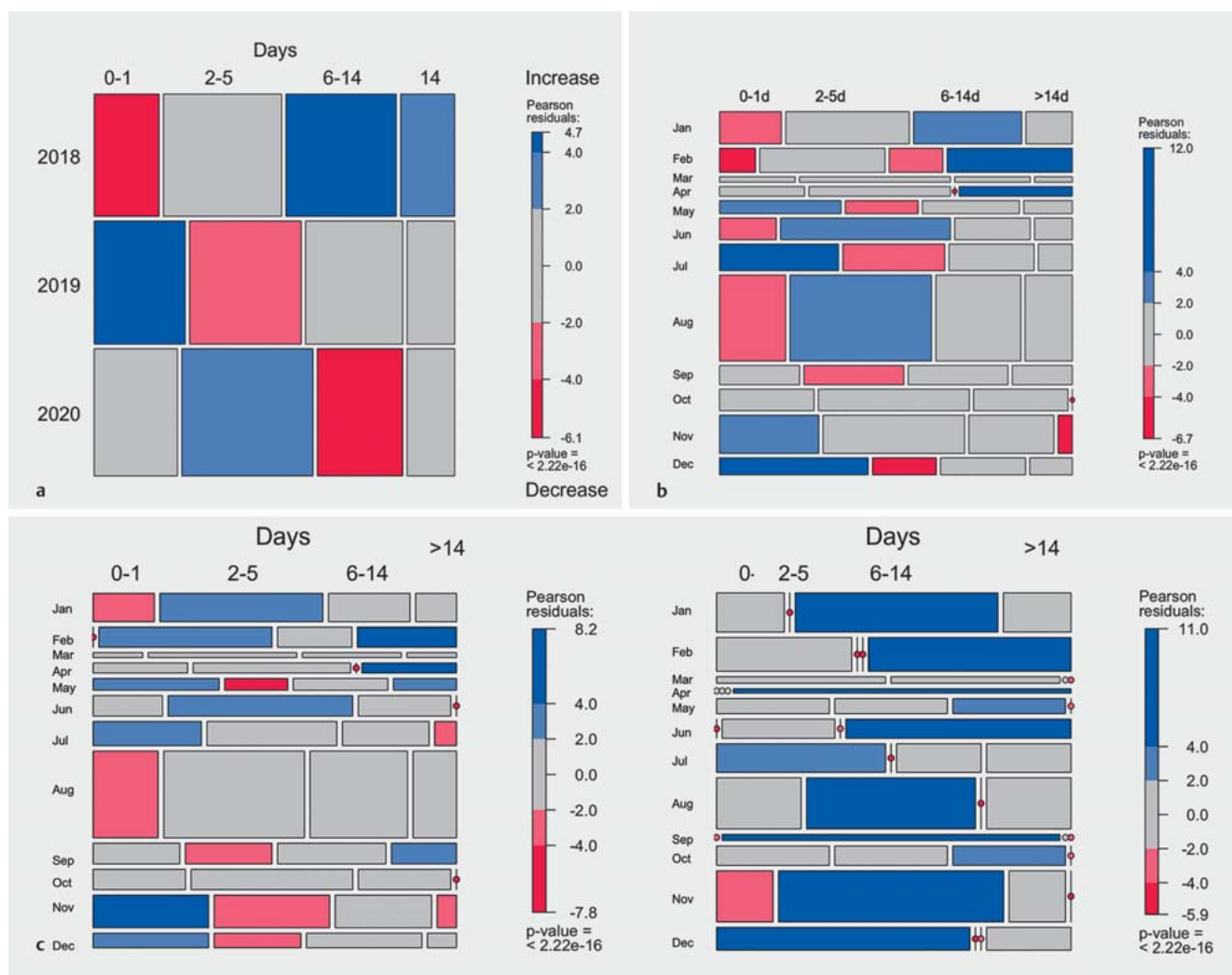
The amount of eyes with involvement of the macula in the detachment, i.e. which were labelled as “macula off”, was 357 (52.2%) in all three years of 2018 to 2020 taken together. In 2018, the number of eyes (47.6%) with detached macula was significantly lower compared to 2019 and 2020 (Chi² test, p < 0.001).

The information about the mean pre-operative best corrected visual acuities per year is also summarized in ► **Table 1**. In 2019 the average pre-operative BCVA was significantly lower than in the year before and after (Mann-Whitney test for 2018 vs. 2019: p-value = 0.019; for 2019 vs. 2020: p = 0.011).

The average time in days from reported symptom onset to hospitalization was 11 days, the median time however was 5 (► **Table 1**), it is noteworthy to see that the median was lower in 2020 compared to previous years. While defining different categories of days from symptom onset to hospitalization it can be noted that overall the amount of patients with longer symptom duration, i.e. > 5 days, seem to have decreased from year to year (► **Fig. 4a**). Especially the patients belonging to the third category, with 5–14 days between symptom onset and hospitalization has declined. In 2020, there appears to be an increase of patients in the category of 2–5 days of symptoms compared to the precedent years. ► **Fig. 4b** depicts the monthly changes of the symptoms' duration in the year of 2020 for the four categories (0–1 day, 2–5 days, 6–14 days and > 14 days): It is mainly in the months of May to September that there were proportional changes with slight increases and decreases of cases in the groups of 0–1 day and 2–5 days of symptoms, respectively. However, an increase of the fourth category (patients with more than 14 days of symptom duration) in the month of February and April 2020. This was similar for patients resident in central Switzerland and Ticino (► **Fig. 4c**), the proportion of patients with longer symptom duration (> 14 d) was however significantly higher in the group of patients with residence in Ticino also for post lockdown months May and June compared to other months of the year 2020.



► **Fig. 3** Mosaic plots for all three years individually showing whether the patients are residents in the Canton of Ticino or not.



► **Fig. 4** Mosaic plot showing proportions of eyes (n = 683) categorized according to the time in days between their reported onset of symptoms and hospitalization. The following categories are represented: 0–1 day, 2–5 days, 6–14 days and > 15 days. **a** Comparison of years 2018 to 2020. **b** Monthly comparison for the year of 2020. **c** Difference in symptom duration between patients with residence in central Switzerland (n = 184 eyes, left) and in the canton of Ticino (n = 41 eyes, right).

Discussion and Conclusion

In summary, yearly total counts of emergency vitrectomies due to cases of retinal detachment did not significantly differ in the years of 2018 to 2020 at the Eye Clinic of the Cantonal Hospital of Lucerne and comparable monthly averages per year were observed. However, the number of cases reached a monthly minimum in March and April 2020, this being the time period of the first Swiss national lockdown. Interestingly, there was a significant difference in the amount of emergency vitrectomies for these months only compared to the prior year, but not compared to 2018. Similarly, when considering the dates of reported onset of symptoms, there were indeed less cases of retinal detachment in the first half of both 2018 and 2020 compared to the second half of the year. As to the previously posed three main questions: (1) A reduction of patients from the canton of Ticino in April could be noted, but the total number of performed overall vitrectomies

was also very low in this period. (2) The number of cases with macular involvement were comparable in 2019 and 2020 and slightly lower in 2018. There was not an increase in cases with macular involvement in the months consecutive to the lockdown. (3) The mean symptom duration was comparable in all three years. The median duration in days was actually lowest in the year of 2020. Considering monthly changes of the year 2020, a significant increase in overall cases with symptom duration of > 14 days was observable in February and April. This pattern was observable both in the group of patients from Ticino and central Switzerland. In the group of patients from Ticino, however the proportion of patients with longer symptom duration was also higher in the months of May and June, i.e. after the lockdown. Since the canton of Ticino was one of most severely affected regions in Switzerland, with initially nearly 5 times more cases compared to central Switzerland and the Lucerne area, the containment measures were also stricter. Taking symptom duration as a proxy for a de-

layed surgical treatment, the higher proportions of cases with longer duration originating from Ticino, suggest that the measures applied there, did influence the treatment management of primary retinal detachments in the initial period of the coronavirus pandemic.

As to the best of our knowledge, only a handful of publications about changes in frequencies of emergency vitrectomies during the coronavirus pandemic are currently available. In contrast to our findings a study from Hamburg did not find a significant decrease of emergency vitrectomies compared to the same time period of the prior year [36]. On the contrary, Kaupke et al. observed a higher number of vitrectomies for the time period of March to May 2020 compared to the year before. Considering the duration from symptom onset to hospitalization, it seems somewhat shorter in median for patients treated in Lucerne compared to the published data of Kaupke and colleagues. Also, a large multicentre cross-sectional study conducted by Breazzano et al. investigated the frequency of billed vitreoretinal procedures in the time period of January to May 2020 [5]. In line with the present findings, they found a decrease in the time period of March 30 to May 2, 2020 for all vitreoretinal interventions, including retinal detachment repair. Furthermore, a reduction in all emergency interventions, not exclusively retinal detachment, was reported by Babu et al. for the lockdown in India [37]. Similarly, a survey from Germany summarized that there was indeed an initial drop especially of elective procedures, but also to some extent of emergency interventions [38].

With regard to the demographical characteristics of the patients treated in Lucerne, these are most comparable to those of the above referenced study from Hamburg [36]; proportion of women, mean age and amount of cases with macular involvement were similar. The study of Breazzano et al. did not report any information on demographics. Furthermore, a study from India, in which the clinical and demographic profile of patients requiring vitreoretinal surgeries during coronavirus lockdown was investigated, patients were on average about 20 years younger than patients treated in Lucerne [39]. In this collective, emergency vitrectomies were mainly conducted for retinal detachment and diabetic complications. Except for a similar proportion (33%) of women in the study, their analysis seems consequently not comparable to the present.

Apart from the supposed limitations of this study, e.g. its retrospective design and the fact that it is a single-centre study, a great strength is that it provides high quality data over a period of multiple years. In contrast to the previously described literature, it therefore enables a comparison over a long period of time and allows the relatively short lockdown duration of six weeks to be placed in the context of several years.

In conclusion, this analysis provides quantitative data on emergency vitrectomies conducted during coronavirus pandemic compared to prior years. Contrasting to previously published research, here a significant reduction in the number of emergency vitrectomies was observed for the initial period of the coronavirus pandemic. As there was no increase in severity (i.e. macular involvement) or prolonged symptoms in the months following the lockdown, delayed emergency presentation is not assumed to be the reason for this initial low. Except for patients from Ticino, where

the proportion of cases with slightly longer symptom duration was higher in the months following the lockdown. Nevertheless, due to a higher incidence of primary retinal detachments later in the year, the earlier observed low incidence was “made up” for, particularly in the month of August 2020.

Conflict of Interest

The authors declare that they have no conflict of interest.

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