The impact of SARS-Covid-19 pandemic on peripheral nerve surgery – a single centre report

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Abstract

Objective

SARS-Cov-19-pandemic totally changed daily routine work in German hospitals. As hospital capacity was reduced, many surgeries were postponed or even cancelled. On March 25th 2020 the German Society of Neurosurgery (DGNC) published a statement in which urgent non-elective surgeries were defined for each neurosurgical domain, whereas elective interventions were deferred. The present work examines the impact of these Covid strategies focusing on patients with peripheral lesions who were conducted to our department during this period of time.

Methods

All patients, who underwent any peripheral nerve surgery at our department from January 2018 until December 2022, were included. The complete range of surgeries including peripheral nerve lesions was examined encompassing compression syndromes, traumatic lesions of brachial plexus, traumatic lesions and tumors of single peripheral nerves. The numbers of surgical procedures were compared before, during and after pandemic. Pearson correlation coefficient was analysed.

Results

From 2018 to 2022 the total number of surgical procedures involving peripheral nerves included 2422 procedures. Compression syndromes made up the largest proportion (1433 operations, 59%), followed by peripheral nerve lesions (445 operations, 18%), peripheral nerve tumors (344 operations, 14%) and lesions of the brachial plexus (142 operations, 6%). The average was 40,5 interventions per month, the range was 7–63. Two declines in the number of peripheral nerve surgeries were noted during this period. The first was in April and May 2020 with an average drop of 65% and 41% respectively. In these months the average number of operations was 37. The second decrease was from October 2021 until January 2022, where number of surgeries was reduced by 16%, 36%, 83% and 18% with an average number of 50 operations. Both declines showed a significant and strong correlation with the lower number of compression syndrome treatments ($r = 0.952, p < 0.001$ and $r = 0.968, p < 0.001$), while no drop and no significant correlation was found in the treatment of traumatic peripheral nerve injuries ($p = 0.769, r = 0.095$ and $p = 0.243, r = 0.366$) and traumatic brachial plexus injuries ($p = 0.787, r = 0.088$ and $p = 0.780, r = 0.09$). A weak significant correlation was seen in the treatment numbers of peripheral nerve tumors ($p = 0.017, r = 0.672$ and $p = 0.015, r = 0.67$).

Conclusion
Covid-19 pandemic lead to a significant decrease in the number of nerve decompressions, since, according to the German Society of Neurosurgery, those were considered as elective surgeries.

**Introduction**

In 2020, the SARS-Covid pandemic reached Germany. Since people got infected in a very short period of time, an increased number of critically ill patients had to be treated in intensive care units. This fact led to a significant burden on medical teams but also to a high material consumption. To relief hospitals elective medical and surgical treatments were supposed to be postponed. In March 2020 the German Society of Surgery released a statement in order to define elective and non-elective operations for each surgical discipline. According to this, the German Society of Neurosurgery published a comment about the postponement of plannable operations. In this, all operations of the several neurosurgical specializations were divided into elective and non-elective. As our centre carries out round about 500 operations on peripheral nerves per year, which makes up to 25% of all interventions, we analyzed, if there was a decrease in the number of peripheral nerve surgeries during the SARS-Covid pandemic.

**Methods**

We performed a retrospective analysis of patients who underwent a peripheral nerve surgery in time frame from January 1st 2018 to December 31st 2022 at the department of peripheral nerve surgery in Guenzburg. The following clinical pictures were differentiated:

- Compression syndromes
- Traumatic lesions of single peripheral nerves
- Traumatic lesions of the brachial plexus
- Tumors of the peripheral nerves

Data was summarized in an excel sheet. The number of operations on the several diseases was examined month per month. The course of surgery figures was illustrated in diagrams. For statistical analysis SPSS 26 (IBM) was used to investigate the Pearson correlation coefficient. The significance level was set if $p < 0.05$.

**Results**

A total of 2422 surgeries involving peripheral nerves were performed (Fig. 1) during the analyzed 5-year period.

The most common diagnosis was compression syndrome, which amounted 1433 surgeries (59%). The second most common procedure was the reconstruction of traumatic peripheral nerve injuries including 445 surgeries (18%), followed by 344 peripheral nerve tumor resections (14%) and 142 brachial plexus traumatic lesions (6%). The monthly average of interventions was 40.5 with (range 7–63 surgeries per
month). During the analyzed months two decreases were recorded. The first one was in April and May 2020, with 14 or rather 24 operations compared to February and March 2020, with 49 or rather 45 operations. The second decline was from October 2021 until January 2022. In these months, 34, 36, 7 and 33 operations were executed (Fig. 2).

Altogether there were three declines in the average number of all operations on peripheral nerves. The first was on March 2020, which correlated to the first lockdown. The second one was on December 2020 and occurred simultaneously with the second lockdown. The third decrease took place after introduction of the “2G-Rule” in December 2021. Interestingly, after each drop of surgeries there was a compensatory increase of surgical procedures during the following two months (Fig. 3).

**Compression syndromes**

Out of 1433 compression syndrome surgeries, in average 23.9 surgeries were performed monthly (range 0–45). Throughout the evaluated time period, there were two decreases in the number of these operations. The first one was in April 2020 and May 2020, where one or rather fourteen operations were performed. The second one was in December 2021, where seven operations were executed. The first decline was simultaneously to the first lockdown, the second one to the Introduction of the “2G-Rule” (Fig. 4). Both declines showed a strong correlation with the decline of treatment numbers in total in this time period: \( r = 0.952, p < 0.001 \) (first decrease) respectively \( r = 0.968, p < 0.001 \) (second decrease).

**Traumatic lesions of single peripheral nerves**

Altogether 445 patients were treated with traumatic lesions of peripheral nerves. The mean average was 7.4 surgeries per month, (range 1–16 surgeries per month). During the observed time period there was no significant decrease and no significant correlation \( (p = 0.769, r = 0.095) \) to the first or second lockdown \( (p = 0.243, r = 0.366) \) or the introduction of the “2G-Rule” (Fig. 5).

**Tumors of peripheral nerves**

The surgical treatment of peripheral nerve tumors included 344 cases (mean 5.7, range 0–11 cases per month). We found only a weak correlation to lower number of surgeries during Covid-19 pandemic \( (p = 0.017, r = 0.672 \text{ year } 2020 \text{ and } p = 0.015, r = 0.679, \text{ Fig. } 6) \).

**Lesions of brachial plexus**

In the observed period from 2018–2022, 142 traumatic brachial plexus injuries were performed (mean 2.4, range 0–7 surgeries per month). There was no significant decrease during the examined time period \( (p = 0.787, r = 0.088 \text{ year } 2020 \text{ and } p = 0.780, r = 0.09 \text{ in year } 2021, \text{ Fig. } 7) \).

**Discussion**
Covid-19 pandemic has strongly affected all fields of medicine. All elective surgeries were postponed leading to the treatment delay with unknown consequences. We have analyzed the impact of Covid-19 pandemic on the surgical treatment of peripheral nerve lesions. As expected, compression syndromes were declared as elective surgical cases according to the German Society of Neurosurgery and were rescheduled and significantly correlated to lower numbers of surgeries during the pandemic.

Presumably, operations on compression syndromes of the peripheral nerves were performed by private practice specialists, as there were no defined restrictions for medical practices. This might lead to a permanent decline in the amount of operations on compression syndromes in specialized hospitals in the future.

Regarding traumatic peripheral nerve lesions, we found no significant decline in the treatment numbers. So the amount of those cases did not change, but there was a change in the injury pattern. As the lockdown forced people to stay at home, more accidents in homework happened, whereas there was a decrease in car accidents and accidents at work was documented. (Pichard et al, 2020).

The proper timing of the intervention is the key point in reconstructive surgery. Since it is well known that a muscle without any innervation will become atrophic in a time period of up to 12–24 months (Robinson, 2000), the optimal treatment time frame of less than six months should be maintained. This is one of the main elements to achieve good functional outcome (Murthy & Spinner, 2020). During the investigated time period, there was no time delay of those surgical interventions. All patients with traumatic peripheral nerve lesions including lesions of the brachial plexus were all treated within 6 months. This is important to stress out, since a successful treatment of these kind of nerve lesions is essential in order to enable patients to return to their profession and daily activities (Houdek & Shin, 2015).

In comparison to this group, Mischkulnig et al. were able to reveal that patients with malignant brain tumors received adequate surgical interventions and treatments on time, so that Sars-Cov2 had no effect on their overall survival (Mischkulnig et al, 2023).

Similar findings were detected in patients with ischemic stroke at the end of the pandemic. But in the early period of Sars-Cov2 there were less treated patients with ischemia which in total led to a higher mortality. One explanation could be a certain fear of people to get into a hospital even suffering of neurologioal deficits (Dengler et al., 2022). Another explanation could be the fact that emergency services and emergency departments suffered from work overload and therefore misdiagnosed strokes.

It can be assumed that this situation was similar to patients with peripheral nerve lesions. But regarding the complete period of time, there was no change in the total number of surgeries in traumatic lesions of single peripheral nerves or of the brachial plexus.

Compared to other clinical syndromes in Neurosurgery lesions of peripheral nerves usually are not life threatening. In case of doubt they play a secondary role in urgency treatment. To avoid negative long-
term effects of untreated traumatic lesions, as mentioned above, there is a need to treat patients in a

certain period of time. Our research show that there was no decline in interventions on peripheral nerve

lesions. The treatment of patients could be preserved even under pandemic conditions which can be

considered a great success. Chapman et al. described recommendations for the therapy of patients with

lesions of peripheral nerves in time of Covid-19 pandemic. They impressed the increasing long-term

morbidity in consequence of a delayed therapy and suggested for example the extension of surgery time

and an interdisciplinary treatment approach as strategies to reduce hospital capacity (Champman et al.,

2020).

Concerning peripheral nerve tumors, the present study revealed a weak correlation in the decrease of

those surgeries. A reason for this fact might be, that most of those tumors are benign, usually not

causing neurological deficits (Adani et al., 2008).

Interestingly, it has been reported that patients with severe Covid-19 disease, who were treated at

intensive care unit for several weeks, have suffered from peripheral nerve injury subsequently. Different
diseases like Guillan Barré Syndrome, Neuralgia, Parsonage Turner Syndrome and especially

compression syndromes were found as well (Andalib et al., 2021, Torres et al, 2022, Roncati et al., 2021).

In Mai 2023 Sars-Cov-19 pandemic was declared officially over. Looking back now, the question arises

whether operations on compression syndromes could have been performed in hospitals. On the one

hand, these kind of procedures are routinely executed ambulatory. Nevertheless, those surgeries bind

personnel capacities and require material resources. Especially in the beginning of Covid-19 pandemic,

there was a major deficiency of sterile drapes and surgical gloves. Knowledge of pathophysiology,

potential outcome after surgical treatment and hospital capacity have to be considered under pandemic

conditions. The guidelines of medical care must also be included (Lockey et al., 2020).

All patients with compression syndromes who have not been or have been operated with a certain delay

might have had persistent neurological deficits despite surgery. Especially, when considering the fact that

postoperative treatments as for instance physiotherapy was additionally limited during this time period.

In the long run the possible negative personnel and economic consequences cannot be estimated at this

time (Twardowska et al., 2023).

Nowadays, the German Hospital reform is already leading to dramatic changes in the field of peripheral

nerve surgery, as more operations, including tumor and trauma, are supposed to be performed in an

ambulatory setting. Considering the increasing multimorbidity of many patients and the distance from

residence to the treating hospital, surgeons and patients encounter new challenges after the Sars-Cov-19

pandemic.

Conclusion
Our data show that treatment of patients with lesions of peripheral nerves, especially tumor and trauma, could be maintained under pandemic situation. There was a delay in therapy of patients with compression syndromes. This might lead to permanent neurological deficits and therefore to a poor outcome. Further studies with focus on this aspect are needed to determine the possible occurring negative long-term consequences.

Declarations

Ethical approval: not applicable (An analysis of numbers was performed. No further data was analyzed.)

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Availability of data and materials: on demand

Conflict of interest: none

References


Figures
Figure 1

Study group divided according to different peripheral nerve lesions

Figure 2

Drop of all interventions in relation to lockdowns and “3G /2G rules”

Figure 3

Compensatory increase of treated cases after each drop
Figure 4

Decline of surgical treated compression syndromes correlated to lockdown and “2G/3G rules”

Figure 5

No correlation between lockdown and 2G/3G rules and the surgical treatment of traumatic nerve lesions

Figure 6

A weak correlation between lockdown and 2G/3G rules and the surgical treatment of tumors of peripheral nerves

Figure 7
No correlation between lockdown and 2G/3G rules and the surgical treatment of lesions of brachial plexus