Safety of the Utilization of Telemedicine for Brain Tumor Neurosurgery Follow-Up

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Abstract

Background: There is a need to evaluate the outcomes of patients who underwent brain tumor surgery with subsequent telemedicine or in-person follow-up during the COVID-19 pandemic.

Methods: We retrospectively included all patients who underwent surgery for brain tumor resection by a single neurosurgeon at our Institution from the beginning of the COVID-19 pandemic restrictions (March 2020) to August 2021. Outcomes were assessed by stratifying the patients using their preference for follow-up method (telemedicine or in-person).

Results: Three-hundred and eighteen (318) brain tumor patients who were included. The follow-up method of choice was telemedicine (TM) in 185 patients (58.17%), and in-person (IP) consults in 133 patients. We found that patients followed by TM lived significantly farther, with a median of 36.34 miles, compared to a median of 22.23 miles in the IP cohort (p = 0.0025). We found no statistical difference between the TM and the IP group, when comparing visits to the emergency department (ED) within 30 days after surgery (7.3% vs 6.01%, p=0.72). Readmission rates, wound infections and 30-day mortality were similar in both cohorts. These findings were also consistent after matching cohorts using a propensity score. The percentage of telemedicine follow-up consults was higher in the first semester (73.17%) of the COVID-19 pandemic, compared to the second (46.21%) and third semesters (47.86%).

Conclusions:

Telehealth follow-up alternatives may be safely offered to patients after brain tumor surgery, thereby reducing patient burden in those with longer distances to the hospital or special situations as the COVID-19 pandemic.

Key Words: Telemedicine, Telehealth, brain tumor, COVID-19, neurosurgical outcomes.

Introduction

Telemedicine (TM), also known as telehealth, can be defined as the use of a technological platform for virtual delivery of health information and medical care.[1] In the last decade, telehealth visits have gradually increased in popularity across all fields, with recent exponential growth spurred by the COVID-19 pandemic. Among surgical specialties, several studies have demonstrated exceptional results in both pre- and post-operative care.[2] While literature regarding telehealth utilization in surgical oncological, breast, ophthalmological, colorectal, and pediatric surgical subspecialties has been documented, a scarcity has been reported on the safety and efficacy of telemedicine in neurosurgery.[3-7] No data has been published regarding the use of telemedicine specifically for brain tumor neurosurgical follow-up. A shift to telemedicine in neurosurgical care could be a pinnacle advancement because brain tumor patients often reside far from the institution in which they were treated. Establishing telemedicine as a safe alternative to in-person (IP) visits could substantially reduce the burden of follow-up in this population, potentially improving access while maintaining optimal outcomes. Further, diminishing the need for in-person follow-up may lower the risk of exposure to hospital and community acquired infections in a typically immunosuppressed population. The objective of this study is to compare the outcomes of neurosurgical patients solely followed by telemedicine alone to those followed exclusively in-person after brain tumor surgery.

Materials and Methods

Study Population

The University of Miami institutional review board approved the present study (protocol #20160437). We retrospectively included all patients who underwent surgery for brain tumor resection by a single neurosurgeon (R.J.K.) at the University of Miami from the beginning of the COVID-19 pandemic restrictions (March 2020) to August 2021. Clinical and follow-up data were collected retrospectively, using inpatient admission, clinic follow-up, and any readmission records. Current zip codes were recorded to calculate distance between the patient's home and the hospital, and they were divided in 3 groups: A:<100 miles, B: 100 – 200 miles, C: >300 miles).

We excluded patients with less than 30 days of follow-up, incomplete demographic data or other types of surgeries (radiosurgery, needle biopsy, endoscopic approaches, etc.).

Clinical Variables

Visits to the ED, readmissions and perioperative mortality variables were registered if they occurred within 30 days after surgery, for any cause. Neurosurgery-related readmission were also registered if they occurred within 30 days after surgery. Wound Infections were defined as those requiring surgical debridement and antibiotics within 90 days after surgery.

Follow-up in the context of the COVID-19 pandemic

We decided to explore the relationship between the date of the surgery in the context of the COVID-19 pandemic. We analyzed the trends of follow-up method in 4 different periods: 6 months prepandemic (9/1/2019 – 2/28/2020), first semester of the pandemic (03/01/2020 – 08/31/2020), second semester of the pandemic (9/1/2020 – 2/28/2021) and third semester of the pandemic (03/01/2020 – 08/31/2020).

Statistical Analysis

All statistical analysis was performed with IBM SPSS v26.0 (IBM, Armonk, NY) and GraphPad Prism at an alpha value of 0.05. A qualitative and quantitative comparison between patients followed by telemedicine (TM) or in-person follow-up (IP) was performed. Categorical variables were compared using a Chi-square test, Fisher´s exact test or Kruskal-Wallis test. Lastly, continuous variables were compared using independent samples t-test for normally distributed variables and Mann Whitney test for non-normal distributions.

Postsurgical Follow-up strategy

All patients were given the option of follow-up with a telemedicine consult or an in-person visit to the clinic after brain tumor surgery. Our standard follow-up schedule is to control patients two weeks after surgery. Telehealth neurosurgical visits included taking a patient history, family history, social history, allergies, current medications, review of systems, and noting current symptoms, concerns, and status. Inspection of the patient's wound and an adjusted neurological examination were carried out via video/web camera. Each virtual visit's documentation was just as detailed and thoroughly reported as in-person.

Propensity Score Match Analysis

Once our initial analysis was done, we performed a post hoc analysis using propensity score matching to mitigate the effect of several variables that may bias our results. A logistic regression was performed to calculate a propensity score using the three most significant variables as predictors: age, pathology diagnosis and distance to the Hospital. Patients were matched 1 to 1 in both cohorts according to the propensity score, using a nearest neighbor approach.

Results

Three hundred and eighteen (318) brain tumor patients who had surgical interventions between March of 2020 and August of 2021 were included in this study (**Table 1**). The median patient age was 58 years old with 47.48% (151/318) of patients being male and 52.2% (166/318) being female. Most common histologic diagnosis was glioma (37.42%), followed by meningiomas and metastases (24.84% and 22.95%, respectively). Median distance from the hospital to the patient´s current residence was 28.13 miles (0.1 - 4432). We found that 260 patients (81.76%) lived within 100 miles to our institution, while 42 (13.20%) were situated between 100 and 200 miles and 16 (5.03%) more than 200 miles from our hospital.

While all patients were followed for at least 30 days, the mean follow-up for the cohort was 41.43 weeks. The follow-up method of choice was telemedicine in 185 patients (58.17%), and in-person consults in 133 patients. We found no statistical difference between both groups when comparing, sex (p=0.96, OR 1.019, 95% CI 0.655 – 1.587), or total follow up (p=0.6841, 95% CI 0.221 – 6.424). When analyzing age in both groups we found that the TM group was older than the IP group, with a respective mean of 60.01 and 54.65 years, respectively (p = 0.0031, 95% CI = 1.824 – 8.885) (Table 2). Regarding the distance to the Hospital, we found that the patients followed by telemedicine lived significantly farther, with a median of 22.23 miles, compared to a median of 36.34 miles in the TM cohort (p = 0.0025).

Patients were admitted on average 3.09 days in the TM group and 3.55 days in the IP group, with no statistical significance. We also compared the number of visits to the emergency department (ED) within 30 days after surgery, and we found no statistical difference (p=0.72, OR=1.181, 95% CI= 0.4620 – 2.832), with 13 patients visiting the ED in the TM group (7.3%) and 8 in the IP group (6.01%). Readmission rates were also similar, with 4.3% of the patients (8/185) in the TM cohort and 2.25% of patients in the IP cohort (3/133), without statistical significance (p = 0.37). Wound infections were present in 5 patients in total, 2 in the populations of patients followed by TM (1.06%) and 3 (2.25%) in those followed by IP visits. External ventricular drains were more frequently used in the IP group (1.61% vs 7.5%, p = 0.009). Systemic infections and thromboembolic events were similar in both groups, with a very low incidence overall (Table 2). 30-day all-cause mortality was 0% in our cohort (Figure 1).

Distance to the Hospital and follow-up method preference

In our study, we found that patients living within 100 miles of the Hospital chose to be followed up in person 42.85% (90/210) of the times, very similar proportion to the preference of patients living farther than 200 miles from the hospital (8/13). In contrast, subjects who had their residencies between 100 and 200 miles from our institution, were only followed up in person 20.51% of the times (8/39). (Figure 2).

Patient follow-up preference in the context of the COVID-19 pandemic.

We found significant differences in the studied periods. During the prepandemic period, all patients were followed by in-person visit to the clinic after surgery. In the first semester of the COVID-19 pandemic, 73.17% (22/104) of the patients were supervised by TM. We observed a significant difference between the first semester and the second/third semesters ($p=0.0077$ and $p=0.0032$, respectively) of the pandemic. In the last two periods, the percentage of patients followed by telemedicine dropped to 46.21% and 47.86%, respectively (Figure 3).

Propensity Score Matched Analysis

We calculated a propensity score using age, distance to the Hospital and pathology diagnosis as predictors. 130 patients were matched on each cohort according to the propensity score, and outcome variables were calculated again in comparing both cohorts. We didn´t find a statistically significant difference in both groups, with similar follow-up, sex, emergency department visits, hospital readmissions and wound infections.

Discussion

Postoperative follow-up via telemedicine for brain tumor patients demonstrates nearly identical outcomes when compared to those followed in-person. Our telehealth cohort revealed no significant difference in total follow-up duration, post-op visits to the ED, readmissions rates, wound infection rates, and perioperative mortality when compared to the in-person visit group. These findings suggest telehealth to be a safe and effective alternative to traditional postoperative follow-up care. Reider-Demer et al. corroborated these findings in a small single-center, pre-COVID19 study for select elective neurosurgeries, however no data specifically for brain tumor surgeries was presented.[6] The lack of discrepancy in outcomes between telehealth and in-person groups may substantiate a shift in the field of neurosurgery to favor telehealth follow-up over in-person visits. Such a change could lead to improvements in healthcare accessibility in the form of decreased travel demands and increased ease of scheduling. Moreover, reduced time spent in hospitals and clinics afforded by TM appointments may lower the risk of exposure to hospital and community acquired infections in these generally immunosuppressed patients[8]. Additionally, institutional and hospital facility advantages of virtual care include lower administrative and provisional costs.[6]

However, providing safe postoperative care in neuro-oncology should be tailored to the specific needs of the patient. In our study, the population included consisted of patients who underwent craniotomy for brain tumor resection, and in the group followed by telemedicine, more than 90% of the lesions were gliomas, meningiomas or metastasis. There are several variables that can influence the decision of the patient when choosing TM or IP follow-up, as the clinical course and perioperative risk in these patients is highly variable. Comorbidities, surgical approach, perioperative complications, longer stay in the intensive care unit or surgical floor, neurologic deficits, are some of the variables that can affect the postoperative plan. Good clinical judgment prevails as the cornerstone of safe neurosurgical care, and these findings should be considered in that context.

In our cohort, preoperative consults during the COVID-19 pandemic were also conducted by telemedicine or in person, according to the preference of the patient. Our population is exclusively composed of patients with brain tumors, who were considered high priority during the COVID-19 pandemic. Compared to other specialties with less-urgent conditions, our strategy was to keep the communication with our patients as fluent as possible, and we achieved that by offering preoperative consultation by telemedicine. We found this strategy to be highly effective during the peaks of the COVID-19 pandemic, and a high percentage of our patients were only physically present at the hospital for the surgical procedure.

Age showed a small but significant difference between the two groups. The average TM patient was almost 6 years older than IP patients in our study. While younger patients are likely to be more tech-savvy and may feel more comfortable with TM technology, older patients have been shown to benefit more greatly from the economic and social implications of telehealth, including reduced healthcare costs, improved self-sufficiency, and heightened quality of life.[9] As technology continues to improve and the TM user-interface advances, this service will likely become a more appealing alternative to younger patient populations while becoming more user friendly and intuitive in the aging and elderly population.

While two thirds of patients in this study lived less than 100 miles from the hospital, we found that in this group, subjects chose to be supervised by TM almost 60% of the time. In contrast, patients who were living between 100 and 200 from the hospital chose TM almost 80% of the time. This trend was not observed in the group living farther than 200 miles from the hospital. One possible explanation for this higher preference for telehealth is that patients living between 100 and 200 miles feel that they are close enough if they need to come to the Hospital during an adverse event, but they prefer to save resources by choosing telehealth for "routine" follow-up visit. On the other hand, patients residing further than 200 miles sometimes feel safer if they stay in a closer temporary residence for the first two weeks after surgery. This trend will likely change as public perception of telehealth improves, however, post-op telehealth rates in neurosurgery are expected to lag behind that of other specialties given the high-impact, high-stakes nature of the field.

In our experience, the workflow from the provider's perspective had to be adjusted to better serve our population during telemedicine consults, but the work burden for the neurosurgeon was not affected overall. This may not be the same in smaller institutions or communities with a different sociocultural background, thus more studies investigating telemedicine usage are needed.

Beyond simply opening follow-up care options to telehealth camera-enabled video visits, it is important to stress the need for further advancement in neurosurgical remote technology. For example, the field of tele-ophthalmology has developed optical coherence tomography (OCT) to provide future affordable, home-monitoring for fluid in neovascular age-related macular degeneration.[7] Home glucometers, ultrasounds, thermometers, pulse oximeters, and blood pressure measuring devices are readily available online to the general public. These devices are often used in cardiology, internal medicine, pediatric, and family medicine virtual visits, by which patients can relay their vitals to their physician and track their health status within the realm of the device used. Apps, such as the ACC/AHA Risk Estimator app for cardiology[10] and electronic headache diaries for neurology,[11] can be used by patients in their homes to track their medical status. These technological advancements may not only aid in at-home prevention, but in virtual triage as well, a crucial aspect of post-op follow-up. Direct involvement of patients in their own healthcare can allow patients and clinicians to unite, fostering a beneficial solidarity[10] that may even mend recent patients' lack of faith in their providers elicited by the COVID-19 pandemic.[12]

One example can be found in a study conducted by Mendez et al[13], that compared conventional vs remote robotic telemedicine programming in patients treated with neuromodulation.Twenty patients were randomly assigned to each group, and they found no difference in the accuracy or clinical outcomes between conventional and remote point-of-care programming. Another study published by Deer et al [14] explored the effectiveness of an FDA-approved digital platform that enables remote programming of an implanted neuromodulation device in patients with chronic pain. All patients (n=16) reported a quick resolution to pain and only 1 required additional follow up.

Our study not only serves to vindicate the use of telehealth in neurosurgical follow-up, but also to initiate a call to action in the neurological and neurosurgical fields to advance technology to bring more useful devices to patients' homes. This availability and patient involvement can further optimize virtual healthcare.

Although limitations of telemedicine did not seem to affect clinical outcomes, it is important to note that certain aspects of the neurological physical exam cannot be completed via telehealth visits, such as reflex, motor, sensory, and some cranial nerve tests. Only deficits in these categories that the patient or their companions notice can be reported. Furthermore, as new technologies[15,16] and minimally invasive surgical techniques[17-19] are incorporated in the neurosurgical field, the role of telemedicine follow-up after those procedures has yet to be defined.

Our study has several limitations that need to be addressed. First, our study is retrospective in nature, and our population includes only patients from a single surgeon in a high-volume academic center, limiting the generalizability of the findings. Second, the COVID-19 pandemic abruptly changed medical management and telemedicine strategies were implemented as a response to the critical situation. Patients chose either TM or IP follow-up according to their preference and possibilities. This was a adequate strategy during the pandemic, but bias may be present as no randomization techniques were used. We performed a matched cohort analysis to mitigate some of the bias. Third, our population included patients who underwent craniotomy for brain tumor resection, with most lesions being gliomas, meningiomas or metastases. Surgeries with a higher surgical risk as intraventricular tumors, large skull base lesions, use of grafts, etc. may require a more frequent follow-up schedule.

Conclusion

Telemedicine is an efficient and safe modality by which to execute post-op follow-up in brain tumor patients. Outcomes of telemedicine follow-up care are comparable to those in-person.

Telehealth follow-up alternatives may be safely offered to patients after brain tumor surgery, thereby reducing patient burden in those with longer distances to the hospital or special situations as the COVID-19 pandemic.

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References

1. Mechanic OJ, Persaud Y, Kimball AB. Telehealth Systems. In: *StatPearls.* Treasure Island (FL): StatPearls Publishing
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2. Gunter RL, Chouinard S, Fernandes-Taylor S, et al. Current Use of Telemedicine for Post-Discharge Surgical Care: A Systematic Review. *J Am Coll Surg.* 2016;222(5):915-927.
3. Irarrázaval MJ, Inzunza M, Muñoz R, et al. Telemedicine for postoperative follow-up, virtual surgical clinics during COVID-19 pandemic. *Surg Endosc.* 2021;35(11):6300-6306.
4. Sonagli M, Cagnacci Neto R, Leite FPM, Makdissi FBA. The use of telemedicine to maintain breast cancer follow-up and surveillance during the COVID-19 pandemic. *J Surg Oncol.* 2021;123(2):371-374.
5. Goedeke J, Ertl A, Zöller D, Rohleder S, Muensterer OJ. Telemedicine for pediatric surgical outpatient follow-up: A prospective, randomized single-center trial. *J Pediatr Surg.* 2019;54(1):200-207.
6. Reider-Demer M, Raja P, Martin N, Schwinger M, Babayan D. Prospective and retrospective study of videoconference telemedicine follow-up after elective neurosurgery: results of a pilot program. *Neurosurg Rev.* 2018;41(2):497-501.
7. Eatz T, Lin, B, Sridhar, J. Impact of Loss to Follow-Up on Treatment for Neovascular Age-Related Macular Degeneration. *Retinal Physician.* 2021.
8. Vallejo FA, Eichberg DG, Morell AA, et al. Same-day discharge after brain tumor resection: a prospective pilot study. *Journal of Neuro-Oncology.* 2022.
9. van den Berg N, Schumann M, Kraft K, Hoffmann W. Telemedicine and telecare for older patients—A systematic review. *Maturitas.* 2012;73(2):94-114.
10. Eatz T, Blumenthal, R, Martin, S. Patients and Clinicians Unite Part Two: Tailored Treatment Is the Best Fit. *US News & World Report.* 2017.
11. Raffaelli B, Mecklenburg J, Overeem LH, et al. Determining the Evolution of Headache Among Regular Users of a Daily Electronic Diary via a Smartphone App: Observational Study. *JMIR Mhealth Uhealth.* 2021;9(7):e26401.
12. Roubille C, Ribstein J, Hurpin G, Fesler P, Fiat E, Roubille F. Confidence vanished or impaired until distrust in the doctor-patient relationship because of COVID-19: Confidence vanished or impaired until distrust: "COVID" in relationship. *Rev Med Interne.* 2021;42(1):58-60.
13. Mendez I, Song M, Chiasson P, Bustamante L. Point-of-care programming for neuromodulation: a feasibility study using remote presence. *Neurosurgery.* 2013;72(1):99-108.
14. Deer TR, Esposito MF, Cornidez EG, Okaro U, Fahey ME, Chapman KB. Teleprogramming Service Provides Safe and Remote Stimulation Options for Patients with DRG-S and SCS Implants. *J Pain Res.* 2021;14:3259-3265.
15. Shah AH, Semonche A, Eichberg DG, et al. The Role of Laser Interstitial Thermal Therapy in Surgical Neuro-Oncology: Series of 100 Consecutive Patients. *Neurosurgery.* 2020;87(2):266-275.
16. Luther E, Lu VM, Morell AA, et al. Supralesional Ablation Volumes Are Feasible in the Posterior Fossa and May Provide Enhanced Symptomatic Relief. *Oper Neurosurg (Hagerstown).* 2021;21(6):418-425.

17. Figueroa J, Morell A, Bowory V, et al. Minimally invasive keyhole temporal lobectomy approach for supramaximal glioma resection: A safety and feasibility study. *Journal of Clinical Neuroscience.* 2020;72:57-62.
18. Govindarajan V, Luther EM, Morell AA, et al. Perioperative Complications in Endoscopic Endonasal versus Transcranial Resections of Adult Craniopharyngiomas. *World Neurosurgery.* 2021;152:e729-e737.
19. Eichberg DG, Di L, Shah AH, et al. Minimally invasive resection of intracranial lesions using tubular retractors: a large, multi-surgeon, multi-institutional series. *Journal of Neuro-Oncology.* 2020;149(1):35-44.

Figure 1. Emergency department visits within 30 days after brain tumor surgery stratified by follow-up method. ED = Emergency Department.

Figure 2. Follow-up stratified by distance from the hospital to the patient’s residence. IP = In-person follow-up. Figure created with BioRender.com

Figure 3. Follow up method in the context of the COVID-19 pandemic. ** = $p<0.01$. ns = not significant

Variable	No. (%)
Total no. of patients	318 (100%)
Female	166 (52.2%)
Male	151 (47.48%)
Median age in yrs., range	
All patients	57.80, 19 – 96
Female	55.77, 19 – 96
Male	59.85, 20 – 95
Tumor Pathology	
Glioma	119 (37.42%)
Meningioma	79 (24.84%)
Metastatic Disease	73 (22.95%)
Other	47 (14.77%)
Distance to the hospital	
All patients, median (range)	28.58 (0.1 – 4432)
< 100 miles, n (%)	260 (81.76%)
100 -200 miles, n (%)	42 (13.20%)
> 200 miles, n (%)	16 (5.03%)
Time to first Follow-up consult	
Mean in days (range)	13 (7-18)
Follow-up in weeks, mean	
All patients	41.43 (±23.76)
Telemedicine	42 (±24.54)
In-person	40.93 (±22.71)
Follow up method	

Telemedicine	185 (58.17%)
In-person	133 (41.82%)

Table 1. Study population characteristics. Distance is expressed in miles. Data is expressed by ± standard deviation of the mean.

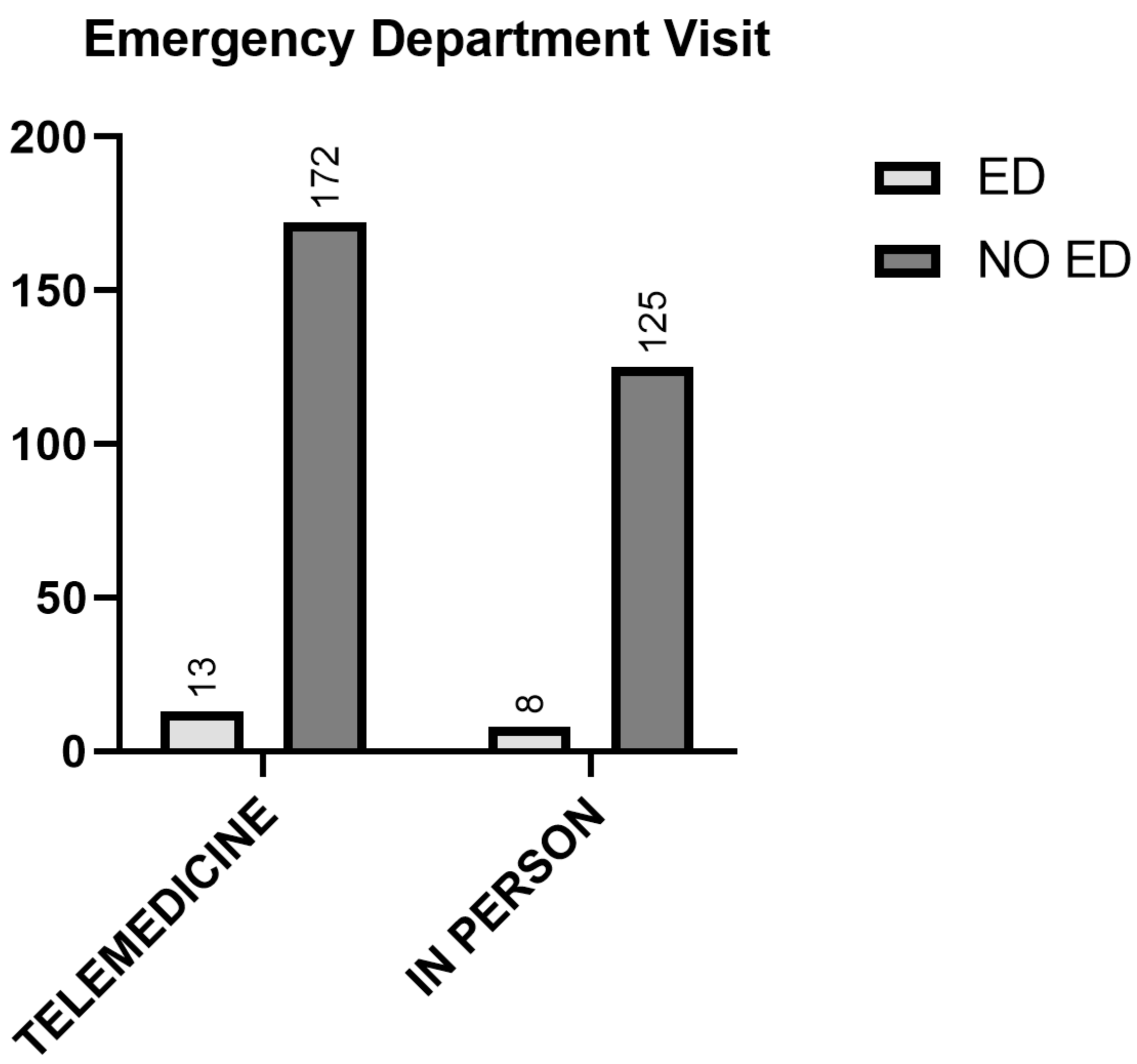
	Telemedicine n=185	In Person n=133	p Value
Age	60.01 (±15.87)	54.65 (±15.57)	** 0.0031
Sex (n Females)	96 (51.89%)	88 (51.85%	0.935
Follow-up, weeks	41.89 (±24.54)	22.71 (±22.71)	0.684
Mean duration of admission, days	3.09 (1-8)	3.55 (1-23)	0.552
ED visit	13 (7.02%)	8 (5.92%)	0.720
Hosp. Readmissions	8 (4.32%)	3 (2.22%)	0.370
External ventricular drain	3 (1.61%)	10 (7.5%)	**0.009
Wound Infections	2 (1.08%)	3 (2.22%)	0.6529
Postoperative hemorrhage	2 (1.08%)	3 (2.22%)	0.6529
Systemic infections	4 (2.16%)	5 (3.7%)	0.387
Thromboembolic events (DVT/PE)	4 (2.16%)	2 (1.48%)	0.657
Distance, Median	36.34	22.23	**0.0025
30-day mortality	0%	0%	

Table 2. Included variables stratified by follow-up method. Data is presented as mean ± standard error of the mean. ER = Emergency Department.

	Telemedicine (n = 130)	In Person (n = 130)	p Value
Sex (n Females)	68 (52.30%)	69 (53.07%)	0.901
Follow-up, weeks	41.72 (±24.88)	41.37 (±22.54)	0.904
ED visit	13 (10%)	8 (6.15%)	0.255
Hosp. Readmissions	8 (6.15%)	3 (2.30%)	0.123
Wound Infections	2 (1.51%)	3 (2.27%)	0.6529
30-day mortality	0%	0%	-
Glioma	83 (63.84%)	83 (63.84%)	0.897
Meningioma	7 (5.38%)	14 (10.76%)	0.111
Metastasis	32 (24.61%)	24 (18.46%)	0.288
Other	8 (6.15%)	8 (6.15%)	0.802

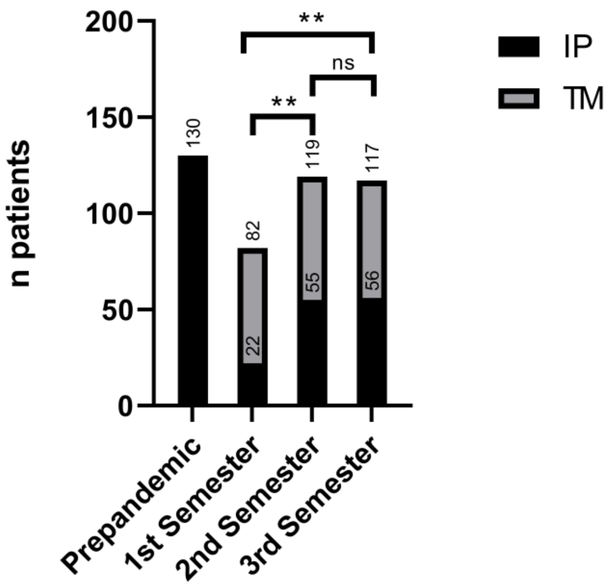
Table 3. Analysis of matched cohorts. Populations were matched according to a propensity score (Binary logistic regression using age, distance to the hospital and pathology distribution as predictors). ED = Emergency Department

Figure 1



Emergency Department Visit
200
150
100
50
0
172
125
13
8
ED
NO ED
TELEMEDICINE
IN PERSON

Figure 2


n patients
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ns
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TM
Prepandemic
1st Semester
2nd Semester
3rd Semester

Figure 3