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Conservative versus operative treatment in supratentorial intracerebral hemorrhage - A survey among neurosurgeons and neurologists in Germany

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ABSTRACT

Objectives: Decision making for surgical therapy in patients with intracerebral hemorrhage is still controversial among neurologists and neurosurgeons. Whereas neurologists may favor conservative treatments, surgeons may opt for operations. This might lead to different therapy decisions.

Patients and methods: Between 2017 and 2018, we conducted a survey among the neurological and neurosurgical societies in Germany. An online questionnaire consisting of 10 fictive patients with spontaneous supratentorial intracerebral hemorrhage (including CT scans and brief case descriptions) was administered to the members of the societies. The participants were asked to decide whether conservative or surgical treatment would be preferred. Furthermore, the results from the neurosurgeons were compared to the results of our previous surveys in 1999 and 2009.

Results: A total of 157 answers were collected (response rate of 16.2%). Nineteen had to be excluded, leaving 138 for analysis (84 neurosurgeons and 54 neurologists). There were no significant differences in therapy decisions between neurologists and neurosurgeons in all ten cases. Comparing the answers from neurosurgeons with our previous results, there were no significant differences between the results from 1999, 2009 and 2017.

Conclusions: Against common prejudices, the process of decision making for or against surgery in patients with spontaneous intracerebral hemorrhage is comparable among conservative physicians (neurologists) and neurosurgeons in Germany. This might be the result of joint efforts in spontaneous intracerebral hemorrhage (ICH) therapy, such as joint guidelines or a society of neurointensive care medicine.

1. Introduction

Stroke is the leading cause of long-term disability and is associated with high mortality rates. Compared to ischemic stroke, the prognosis of spontaneous intracerebral hemorrhage (ICH) is significantly worse. Therefore, much effort has been made to improve the outcome of patients with ICH by developing novel surgical approaches such as craniectomies or minimally invasive surgeries [1–6]. In 2012, we published the results of a survey that was conducted among the members of the neurosurgical society in Germany in 1999 and again in 2009 [7]. The neurosurgeons were asked to decide between conservative or surgical treatment. Surprisingly, there were no significant differences regarding the decision for or against a surgical procedure in 1999 and in 2009. Furthermore, although unfavorable prognostic factors have been known for many years, surgical procedures have been chosen even in cases with an obviously poor prognosis [7]. After almost another decade, we again conducted the previous survey among the neurosurgical centers in Germany. The survey was extended to include neurologists. Whereas neurologists may favor conservative treatments, surgeons may opt for operations. This might lead to different therapy decisions. We therefore performed a survey among German neurointensivists from both faculties. Aim of our study was to illustrate decisions in ICH therapy amongst neurologists and neurosurgerons in Germany. Our hypothesis was, that neurosurgeons would choose operations more often than neurologists.

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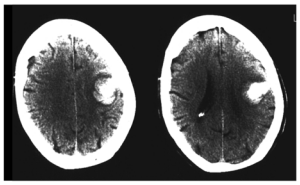
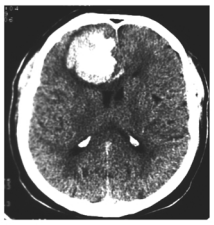
Patient 1
70-years old male in good general health, 2 days ago sudden headache followed by a right sided hemiparesis. At the time of admission the patient is alert and orientated with a right sided hemiparesis.

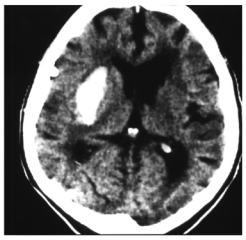


Patient 2
48-years old male in good general health, no previous history, in the morning severe headache and confusion. On admission in the afternoon patient is alert and orientated in all dimensions with a slight HOPS, further neurological exam is normal.

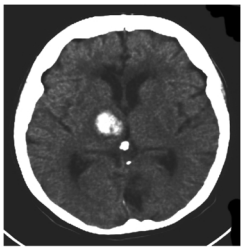


Patient 3
65-years old female in slightly reduced general health, diabetes mellitus. In the afternoon acute severe right sided hemiparesis. On admission decreased consciousness, severe right sided hemiparesis.

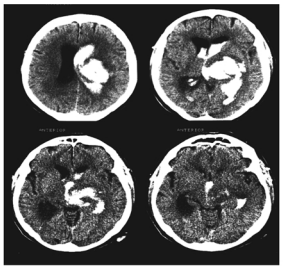
Patient 4
74-years old male, myocardial infarction 8 years ago, no drug prescription, at noon acute left sided hemiparesis. Admission in an external hospital, after CT-scan colleagues ask for surgery. At this time patient is alert, well orientated with a fair left sided hemiparesis.



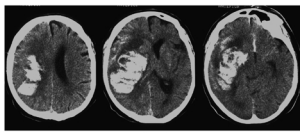
Patient 5
40 years old female in good general health. Sudden headache, prickling in the left arm and slight weakness in the left hand. Admission in a neurological department. After CT-scan colleagues ask for surgery. Patient is alert, well orientated, left sided hemihypesthesia, slight weakness in the left hand, no hemiparesis



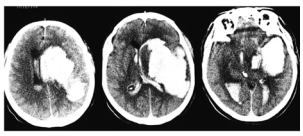
Patient 6
72-years old male in reduced general health, patient was found unconscious at home. On arrival of the emergency physician patient is unconscious, fixed and dilated pupil on the left side, flexor posturing on pain stimulus. On admission patient is sedated, intubated and ventilated, anisocoria with a fixed and dilated pupil on the left side. No motor response because of sedation, corneal reflex and cough reflex is preserved.



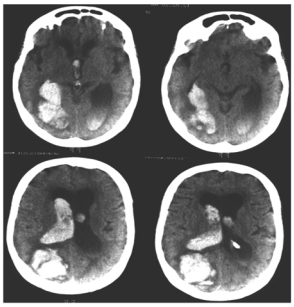
Patient 7
48-years old female, while slowly progressing loss of consciousness an emergency call is initiated. On arrival of the emergency physician the patient is comatose, with anisocoria and extensor posturing on pain stimuli. On admission patient is intubated and ventilated with extensor posturing and dilated and fixed pupils on both sides.



Patient 8
68-years old male in reduced general health. Patient was comatose when emergency physician arrived. On admission the patient is intubated and ventilated. Left pupil is dilated and fixed. A responds to pain stimuli is not available because of sedation.



Patient 9
77-years old female in reduced general health. Patient was found with reduced consciousness. After CT-scan patient is somnolent, confused, no hemiparesis, no aphasia, pupils equal, round, reactive to light and accomodation. No further information provided because of confusion.



Patient 10
59 years old left handed male in good general health. After sudden headache he developed a severe left sided hemiparesis. On admission patient is somnolent with severe left sided hemiparesis and hemihypesthesia, no aphasia.

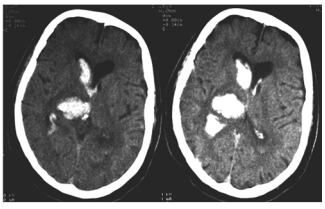


Fig. 1. The figure shows the different cases of our questionnaire (case 1–10). Each case consisted of a fictive patient represented with a slice from a CT scan as well as a brief case description.

2. Material and methods

In Germany, patients with ICH are treated by both neurologists and neurosurgeons. Neurologists and neurosurgeons can further spezialise their skills for another 2 years to become an neurointensivist. In the following we use the term neurointensivist and experienced neurologist or experienced neurosurgeon synonymously. Between November 2017 and March 2018, we conducted an online survey among neurointensivists in Germany covering both neurosurgeons and neurologists. We used the online platform SurveyMonkey (surveymonkey®, www.surveymonkey.de) to conduct our questionnaire. This study was performed in accordance with the German Society of Neurosurgery and the German neurointensive care society (DGNI). A request to participate in our survey was sent via e-mail to all members of the DGNI, which

consisted of 967 members in 2017. Furthermore, a link to the survey was placed on the society homepage.

This questionnaire contained ten different cases of ICH. Each case consisted of a fictive patient represented with a slice from a CT scan as well as a brief case description (Fig. 1) Cases with infratentorial lesions (brainstem or cerebellar) were not included. Only if all ten cases were answered completely the questionnaire was used for analysis.

First, the participants were asked to decide whether a surgical or conservative treatment should be initiated. When choosing surgery, the participants could decide among different options, such as open surgery, microsurgery, stereotactic aspiration, fibrinolytic therapy, an application of an external ventricular drainage system or a combination of these approaches. Multiple responses were possible.

Furthermore, we requested the following personal data: gender, age, years of professional experience and the number of treated ICH cases per year. To evaluate the differences in therapy decisions, we compared the answers from the neurosurgeons and the neurologists to each other. The questionnaires were evaluated anonymously. Furthermore, the actual answers from the neurosurgeons were compared to the results of our previous survey administered among the members of the neurosurgical society in 1999 and again in 2009.

The study was presented to the ethics committee of the local state medical chamber (Landesärztekammer Hessen, Germany) but did not require approval due to missing factual patient data.

Data were analyzed using IBM® SPSS® Statistics R (Version 2.14.1; The R Foundation for Statistical Computing). Fisher's exact test was used to determine associations between operative versus conservative treatment options and differences between the two groups of neurointensivists (neurologist/neurosurgeon). A p value of < 0.05 was considered significant. All p values and confidence intervals were corrected for multiple comparisons by applying the Bonferroni method.

3. Results

A total of 967 questionnaires were delivered to all the members of the DGNI, and 157 answers were collected, representing a response rate of 16.2%. In 1999 and 2009, 85 and 111 questionnaires were evaluated, respectively.

Of these 157 return questionnaires, 19 had to be excluded due to incomplete data, leaving 138 for analysis: 84 were answered by neurosurgeons and 54 by neurologists. Table 1 shows the details of the participants. The majority of the physicians were male in both groups (overall, m : f = 82% : 18%). Approximately 78.5%, 62.5% and 42.7% of the participants treated more than 30, 40 or 50 cases of ICH patients per year, respectively. There were no significant differences in gender (p = 0.164), age (0.144), years of professional experience (0.225) and the number of treated ICH cases per year between neurologists and neurosurgeons (p = 0.640), respectively.

All 10 illustrative cases are shown in Fig. 1. Therapy decisions between neurologists and neurosurgeons are displayed in Table 2. There were no significant differences in all 10 cases between the two groups. Case 3, 6 and 7 showed larger percentage differences between neurologists and neurosurgeons (37 versus 51%, 35 versus 57% and 35 versus 57%, respectively) but all of them failed to reach p-value threshold.

Table 3 shows the therapy decisions for or against surgery from the neurosurgeons in Germany. There were no significant differences between the responses from 1999, 2009 and 2018. The analysis of subgroups for the different approaches of surgical treatment are published online as **Supplemental Data**.

4. Discussion

We conducted a survey among neurointensivists in Germany and asked them to decide whether conservative or surgical treatment would be preferred in 10 different ICH cases. Our results showed that neurosurgical practices in therapy decisions have remained stable over the last two decades. There were no significant differences between the survey responses from 1999, 2009 and 2017. Furthermore, our survey did not show any significant differences in therapy decisions between neurosurgeons and neurologists.

ICH is associated with high mortality and morbidity. One-third of the survivors end up with severe disability or death in the follow-up period after hospital discharge [8], resulting in enormous social and economic effects [9]. The mortality of ICH has not improved substantially over the past years [3,10]. Overall, there are only a few proven treatment options [11]. The therapeutic decisions made by

Table 1
Demographic data of the participants. There were no significant differences between neurologists and neurosurgeons (Fisher's exact test).

	overall (%)	neurologist (%)	neurosurgeon (%)	*p*-value
gender				
male	82	75.5	85.7	0.164
female	18	24.5	14.3	
age (years)				
21–29	3.8	6.1	2.4	0.144
30–39	25.6	28.6	23.8	
40–49	28.6	36.7	23.8	
50–59	30.8	20.4	36.9	
≥ 60	11.3	8.2	13.1	
professional expierences (years)				
0–5	26	37.8	19.5	0.225
6–10	17.3	20	15.9	
11–15	14.2	11.1	15.9	
16–20	11	6.7	13.4	
21–25	11.8	8.9	13.4	
26–30	7.1	8.9	6.1	
> 30	12.6	6.7	15.9	
numbers of patients treated per year				
1–10	1.6	0	2.4	0.640
11–20	5.3	2.1	7.2	
21–30	14.5	12.5	15.7	
31–40	16	16.7	15.7	
41–50	19.8	16.7	21.7	
> 50	42.7	52.1	37.3	

Table 2
Decisions for conservative therapy or surgery between neurologists and neurosurgeons. Overall, there were no significant differences in all 10 cases. N = neurologist, NS = neurosurgeon, OR = odds ratio.

case	speciality*	conservative therapy (n)	(%)	surgery (n)	(%)	*p*-value after Bonferroni adjustment
1	N	42	77.8	12	22.2	1
	NS	73	86.9	11	13.1	
2	N	35	64.8	19	35.2	1
	NS	43	51.2	41	48.8	
3	N	20	37.0	34	63	1
	NS	43	51.2	41	48.8	
4	N	54	100,00	0	0	1
	NS	81	96.4	3	3.6	
5	N	53	98.1	1	1.9	1
	NS	83	98.8	1	1.2	
6	N	19	35.2	35	64.8	0.6
	NS	48	57.1	36	42.9	
7	N	19	35.2	35	64.8	0.6
	NS	48	57.1	36	42.9	
8	N	37	68.5	17	31.5	1
	NS	69	82.1	15	17.9	
9	N	6	11.1	48	88.9	1
	NS	11	13.1	73	86.9	
10	N	13	24.1	41	75.9	1
	NS	14	16.7	70	73.3	

Table 3
Decision from neurosurgeons in Germany for surgery or conservative therapy. There were no significant differences between the responses from 1999, 2009 and 2018. N = neurologist, NS = neurosurgeon, OR = odds ratio.

case	year of the survey	conservative therapy		surgery		years	*p-value (nominal)*	*p*-value (after Bonferroni adjustment)
		n	%	n	%			
1	1999	74	87.06	11	12.94	1999 - 2018	0.45	1
	2009	95	85.59	16	14.41	2009–2018	0.63	1
	2018	115	83.33	23	16.66	1999–2009	0.77	1
2	1999	37	43.53	48	56.47	1999–2018	0.06	1
	2009	64	57.66	47	42.34	2009–2018	0.86	1
	2018	78	56.52	60	43.48	1999–2009	0.05	1
3	1999	43	50.59	42	49.41	1999–2018	0.47	1
	2009	62	55.86	49	44.14	2009–2018	0.11	1
	2018	63	45.65	75	54.34	1999–2009	0.46	1
4	1999	79	92.94	6	7.06	1999–2018	0.09	1
	2009	109	98.20	2	1.80	2009–2018	0.84	1
	2018	135	97.82	3	2.17	1999–2009	0.09	1
5	1999	84	98.82	1	1.18	1999–2018	0.86	1
	2009	109	98.20	2	1.80	2009–2018	0.83	1
	2018	136	98.55	2	1.45	1999–2009	0.73	1
6	1999	43	50.59	42	49.41	1999–2018	0.77	1
	2009	62	55.86	49	44.14	2009–2018	0.83	1
	2018	67	48.55	71	51.45	1999–2009	0.46	1
7	1999	40	47.06	45	52.94	1999–2018	0.83	1
	2009	54	48.65	57	51.35	2009–2018	0.99	1
	2018	67	48.55	71	51.45	1999–2009	0.83	1
8	1999	52	61.18	33	38.82	1999–2018	0.01	0.54
	2009	92	82.88	19	17.12	2009–2018	0.24	1
	2018	106	76.81	32	23.19	1999–2009	0.00	0.03
9	1999	17	20.00	68	80.00	1999–2018	0.12	1
	2009	17	15.32	94	84.68	2009–2018	0.49	1
	2018	17	12.32	121	87.68	1999–2009	0.39	1
10	1999	12	14.12	73	85.88	1999–2018	0.30	1
	2009	18	16.22	93	83.78	2009–2018	0.50	1
	2018	27	19.57	111	80.43	1999–2009	0.69	1

neurosurgeons in the present survey were exactly the same as those of our surveys in 1999 and 2009. We had already discussed this fact in our previous publication [7]. However, the question still remains why there were no differences in therapy decisions after almost two decades in spite of increasing publications dealing with ICH. First, surgical treatment of large cerebellar intracerebral hemorrhages is still accepted despite the lack of randomized controlled trials [2,11]. Of note, these cases were not included in our survey. Therapeutic strategies in ICH are less clearly defined. In particular, the treatment of supratentorial intracerebral hemorrhage is still considered very controversial [2,12–14].

There are different scales serving as prognostic instruments to predict mortality and worsened outcomes even if used within the first days of treatment [15–17]. However, many patients still undergo surgical procedures, despite knowledge of clearly unfavorable prognostic factors. This was true for neurosurgeons as well as neurologists and might be explained by the fact that clinicians act in good faith to help patients in critical life-threatening situations. Surgery is widespread across various forms, such as minimally invasive surgery with stereotactic aspiration with or without fibrinolytic agents or isolated hemicraniectomy. To date, different trials have not been able to establish a generally accepted treatment strategy for or against surgery [4,5,18]. The current guidelines recommend that for most patients with supratentorial ICH, the usefulness of surgery is not well established [19,20]. Deep intracerebral hemorrhages in the area of the basal ganglia without ventricular rupture are generally treated conservatively [4,11,13]. This was also demonstrated by our survey. Minimally invasive surgery may limit surgical tissue injury. Recently, encouraging results from a subgroup analysis of the MISTIE trial were published [21]. Improvements of functional outcome in a randomized trial have been shown for a subgroup of patients with ICH undergoing surgery by a minimally invasive approach. Greater ICH reduction was associated with a higher likelihood of achieving a better functional outcome (modified ranking score 1–3). However, further research is necessary to identify patients who would clearly benefit from surgical therapy.

Medical decision making is very complex, and it is vulnerable to errors and biases due to previous education, experiences, areas of expertise and personal values [22]. For example, a survey among neurosurgeons showed that they chose treatment options for themselves that were different from what they would have chosen for their patients [23]. There are only few data in the literature about differences in surgical vs non-surgical decision making. A survey among neurologists and neurosurgeons on the treatment of chronic subdural hematoma showed ambivalence in the different therapy options but no significant differences in therapy decisions between both physician groups [24]. However, treating patients through specialists results in better outcomes. The appointment of a neurointensivist-led team is associated with an independently positive impact on patient outcomes, including lower mortality, fewer days of hospital stay and higher rates of discharge home [25]. This is also true for patients with ICH [26]. In Germany, patients with ICH are treated by both neurologists and neurosurgeons. In our study, there were no significant differences in therapy decisions between the two specialties. This was counter to our expectation, as we thought neurologists would be more in favor of conservative treatment, while surgeons would undoubtedly prefer a surgical approach; the unexpected consensus between neurologists and neurosurgeons in therapy decisions was a pleasant result. In 2008, the German society of neurointensive care medicine (Deutsche Gesellschaft für Neurointensive und Notfallmedizin, DGNI; www.dgni.de) emerged

from neurological and neurosurgeon intensive care societies. A joint annual congress and joint scientific projects were established. Furthermore, joint guidelines have been drafted for ICH therapy by the German neurological society and the German society of neurosurgery [20]. These achievements might explain the uniform therapy decisions of both faculties.

There are some limitations of our survey. First of all, the response rate of 16% was very low and a number of questionaires had to be excluded which may have let to signifiant bias. For example, case 3, 6 and 7 showed larger percentage differences between neurologists and neurosurgeons but failed to reach p-value threshold. This might be due to the small number of participants. Response rates in 1999 and 2009 were much higher than in 2019. This might be explained by the different ways the queries were sent to the participants (1999 and 2009 by post, 2019 via email using an online plattform to fill in the answers). Furthermore, the survey has been conducted in Germany. The results are not necessarily valid for other countries.

In conclusion, there were no differences in therapy decisions between neurosurgeons and neurologists. Furthermore, therapy decisions from the neurosurgical society in Germany have remained stable over the last two decades. We believe that joint efforts among neurosurgeons, neurologists and other neurointensivists are important to have common guidelines and therapy standards in patients with intracerebral hemorrhage.

Disclosures for all authors

None.

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.clineuro.2019.105502.

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