EVIDENCE IN NEUROSURGERY ACCORDING TO NEUROSURGEONS: PRELIMINARY RESULTS OF AN INTERNATIONAL SURVEY

Jill Martens[1,2], Ronald H.M.A. Bartels MD PhD[1], Guido A. de Jong MSc[1]

[1]Department of Neurosurgery, Radboud University Medical Center, Nijmegen, the Netherlands

[2] Bachelor Student Medicine, Radboud University Medical Center, Nijmegen, the Netherlands

Abstract

Original Research

BACKGROUND: The publication rate of neurosurgical guidelines had increased immensely over the past five years. But it seems only a small proportion of the clinical decisions is based on high-quality evidence. Surgeons do not seem to implement new evidence quickly.
OBJECTIVE: To evaluate the criteria of evidence within neurosurgery and its value within clinical practice according to neurosurgeons.
METHODS: A web-based survey was sent to 2552 neurosurgeons, who were members of the European Association of Neurosurgical Societies (EANS).
RESULTS: 82 neurosurgeons responded within the first five days and were subject of the current study. According to 49.4% of the responders, neurosurgery is based on less evidence compared to other medical specialties, and enough high-quality evidence is not available to base clinical practice on. Although, 86.7% of the responders believed neurosurgery is amenable to evidence. A statistically significant difference existed between neurosurgeons with and without formal training in Evidence Bases Medicine (EBM) in understanding, criticising and interpreting statistical outcomes in journals (P = 0.001).
CONCLUSION: According to the responders, neurosurgery is less based on high-quality evidence compared to other medical specialties. Formal training in EBM is desirable, so neurosurgeons can understand, criticise and interpret statistical outcomes in journals better.

WHAT'S KNOWN: Evidence-based practice is the golden standard in medicine and is believed to be wide spread in medicine.

WHAT'S NEW: According to neurosurgeons from different countries, evidence-based practice within neurosurgery is not so evident as might have been suggested.

KEYWORDS: neurosurgery, evidence, survey, opinion

Introduction

Evidence-based practice is the golden standard in multiple medical specialties, including neurosurgery [1-3]. Sackett et al. [4] defined evidence-based medicine as 'the conscientious, explicit and judicious use of current best evidence in making decisions about the care of individual patients'. Evidence is defined as 'the available body of facts or information indicating whether a belief or proposition is true or valid' [5].

The publication rate of neurosurgery guidelines in the past 5 years is nearly 10-fold that from the preceding decades [6]. Nevertheless, it is estimated that only 10 to 25% of clinical decisions are based on high-quality evidence [7]. Surgeons do not seem to implement new evidence immediately. Especially when the new evidence is involving new procedures. They prefer to wait for trusted and influential leaders in the community to pronounce their verdict about the new knowledge [7-8].

Before evidence is implemented in clinical practice, surgeons form a judgement about the available evidence. This study evaluated the opinion of neurosurgeons worldwide on the evidence available and if it is implemented in clinical practice of neurosurgery.

Methods

A 'cross-sectional' survey among 2552 members of the European Association of Neurosurgical Societies (EANS) was performed. The survey focused on the opinion on the levels of evidence of neurosurgical studies, on the understanding of the levels of evidence, and to what extent neurosurgeons implement evidence in clinical practice. Table 1 shows an example of the different levels of evidence in neurosurgery [9].

The survey was made with Google Inc. Forms and e-mailed directly to the participants by the administration of the European Association of Neurosurgical Societies (EANS). The survey consisted of 13 sections containing 22 questions in total. Sections with multiple questions within the survey were randomised, in order to minimise the influence of the sequence of questions on the answer. Participants were asked their opinions on high-quality evidence, the usability of researches, the amenability of neurosurgery to evidence, the quality of guidelines in their hospital and of the guidelines used by the neurosurgeon, and the important factors for choosing between treatments. (Table 2 shows the questions within the sections.) Also, the participants were asked if they received formal training in Evidence Bases Medicine (EBM) and if they considered themselves capable of understanding, criticising an interpreting statistical outcomes in journals. Most questions had answers as a five-item Likert scale. This scale was chosen because each item is of equal value so that respondents are scored rather than items, it is likely to produce a highly reliable scale, and it is easy to read and complete [10]. The remaining questions were polar questions or choices between statements. Participation was voluntary and completely anonymous, and the purpose of the survey was explained to the participants.

***Table 1:** Diferent levels of evidence in neurosurgery.*
Rutka JT. Classes of evidence in neurosurgery. J Neurosurg 2016; July 1; 1-2

Evidence Level	Description
I	1) Randomized controlled trial (RCT); 2) Meta-analysis of randomized controlled trials with homogeneous results
II	1) Prospective comparative study (therapeutic); 2) Meta-analysis of Level II studies or Level I studies with inconsistent results
III	1) Retrospective cohort study; 2) Case-control study; 3) Meta-analysis of Level III studies
IV	1) Case series
V	1) Case report; 2) Expert opinion; 3) Personal observation

Data was collected over a period of five days from the date of first mailing. Questionnaires of all responders until the 27th of May 2017 were included in the first analysis. Two reminders will be sent.

Statistical analyses
For statistical analyses SPSS version 22 (Statistical Package for the Social Sciences) was used. For continuous data student t-tests were used, whereas for categorical data Chi-square tests. A P-value < 0.05 was considered statistically significant.

Results

A total of n=82 responses was collected (response rate of 3,2% after five days), and 1 response was excluded because the responder was still a resident. Thus, n=81 responses were taken into consideration.

Table 2 describes demographics from the responders. 30.9% of the responders, were working as a neurosurgeon between five and ten years, and almost all responders, 97.5%, were specialized in one or more subspecialty. Of the 81 included responders, 65 responders came from 24 EU-countries, mostly from Germany, Greece, Italy and the Netherlands. The 16 remaining responders came from 11 countries outside of Europe, mostly India, Iraq, Mexico, Saudi Arabia and the United States of America. The overall results of the survey are summarised in Table 3.

Figure 1 shows the opinion of the responders regarding the level of evidence in respect to high-quality and use in clinical practice. According to 53.0% of the responders, Level I or Level I and Level II are considered high-quality evidence. The results of research of all levels of evidence were used for implementation in clinical practice, except for randomised controlled trials (RCTs) with inconsistent, but promising, results (45.7%) (Figure 2).

Neurosurgery is amenable to evidence according to 86.7% of the responders. However, in the opinion of 49.4% of the responders, neurosurgery is less based on evidence compared to other medical specialties. Of those who thought that neurosurgery was amenable to evidence, 45.1% said neurosurgery was less based on evidence compared to other medical specialties as opposed to 80.0% of the group who did not think neurosurgery was amenable to evidence. The difference was statistically significant (P = 0.048).

The treatment options used were considered to be based on no high-quality evidence by 9.9% of the responders, whereas 72.8% stated that they were, and 17.3% had no opinion.

Formal training in EBM was received by 42.0% of the responders. The responders with and without formal training in EBM did equally consider their treatment options as high-quality, 73.5% respectively 71.4%. Of the responders with formal training in EBM, 5.9% considered their treatment options as not based on high-quality evidence as opposed to 17.1% of the responders without formal training. Comparing neurosurgeons with and without formal training in EBM a difference existed in their opinion to be able to understand, criticise and interpret statistical results in published studies, 94.1% respectively 65.7% (P = 0.001). This difference was not present when neurosurgeons with additional qualifications were compared with those without, 84.5% respectively 75.0% (P = 0.064).

***Table 2:** Demographics of the responders*

Years working as a neurosurgeon	
1-5	16 (19,8%)
5-10	25 (30,9%)
10-15	16 (19,8%)
15-20	7 (8,6%)
20-25	4 (4,9%)
> 30	10 (12,3%)
Academic qualifications	
Yes[1]	45 (55,6%)
Professor	10 (17,55%)
PhD	30 (52,6%)
MSPH	2 (3,5%)
MPH	5 (8,8%)
Other	10 (17,55%)
No	36 (44,4%)
Subspecialty	
Yes[2]	79 (97,5%)
Neurocritical care	30 (12,9%)
Cerebrovascular neurosurgery	31 (13,3%)
Neuroendovascular surgery	5 (2,2%)
Spinal neurosurgery	55 (23,6%)
Neurosurgical oncology	58 (24,9%)
Pediatric neurosurgery	22 (9,4%)
Peripheral nerve neurosurgery	14 (6,0%)
Stereotactic and functional neurosurgery	14 (6,0%)
Other	4 (1,7%)
No	2 (2,5%)

[1]24,4% of the neurosurgeons that answered 'Yes', had more than one academic qualification
[2]86,1% of the neurosurgeons that answered 'Yes', had more than one subspecialty
PhD = Doctor of Philosophy, MSPH = Master of Science in Public Health, MPH = Master of Public Health

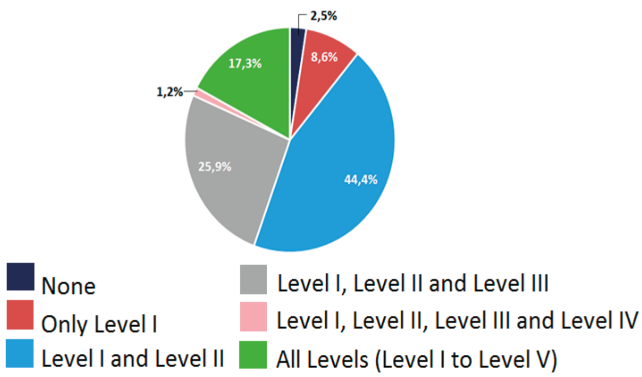

***Figure 1:** Opinion of levels of evidence considered high-quality evidence and usable in clinical practice.*

Table 3: *Summery of the overall results of the survey*

Factors important for choosing a treatment	**Strongly agree or agree**	**Indifferent**
Local context and environment are important factors for choosing a treatment	72.9%	25.9%
Knowledge from patients and carers is an important factor for choosing a treatment	74.1%	22.2%
Research is an important factor for choosing a treatment	91.4%	7.4%
Clinical experience is an important factor for choosing a treatment	100%	
Usage of researches in clinical practice	**Strongly agree or agree**	**Indifferent**
Usage of (meta-analysis of) RCTs with inconsistent, but promising results in clinical practice	45.7%	37.0%
Usage of case reports, expert opinions or personal observations in clinical practice	59.3%	29.6%
Usage of case series in clinical practice	61.8%	29.6%
Usage of case-control studies in clinical practice	61.8%	23.4%
Usage of (meta-analysis of) retrospective cohort studies in clinical practice	72.9%	24.7%
Usage of (meta-analysis of) RCTs with homogenous results in clinical practice	72.9%	22.2%
Usage of meta-analysis of prospective cohort studies in clinical practice	75.3%	21.0%
Usage of prospective cohort studies in clinical practice	77.8%	18.5%
Guidelines and treatment options	**Strongly agree or agree**	**Indifferent**
Guidelines at my hospital are based on high-quality evidence	64.5%	19.0%
Treatment options I use are based on high-quality evidence	72.8%	17.3%
The neurosurgeons at my hospital do have a say in drawing up neurosurgical	72.8% (Yes)	2.5% (Other)
Training	**Strongly agree or agree**	**Indifferent**
Receive formal training in EBM	42.0%	14,8%
Can understand, criticise and interpret statistical outcomes in journals	80.3%	11,1%
Neurosurgery is amenable to evidence	86.7%	9.9%

RCT = Randomised Controlled Trial, EBM = Evidenced-based Medicine

Discussion

This study is unique since it is, in our opinion, the first that evaluated the opinion of neurosurgeons in several countries regarding evidence-based medicine in neurosurgery. Level I or Level I and Level II are considered high-quality and usable evidence by 53.0% of the responders (8.6% resp. 44.4%). But it seems that all levels of evidence are used by most neurosurgeons. Several neurosurgeons commented that the lack of evidence is an important issue in neurosurgery and reason for this finding. One commented: "The issue is, RCTs are expensive and difficult to perform. Well designed, prospective, pragmatic comparative studies could be equally informative and easier to run. Yet, RCTs are the higher level of evidence and form the basis of guidelines. It is my observation that we therefore 'dismiss' other study design. If true, this is holding us back."
RCTs are more difficult and expensive to perform and are probably therefore less performed. In addition, 8,6% of the responders find only Level I, RCTs, is considered evidence. This is a well-known myth of evidence-based medicine (EBM) [11]. But, EBM evaluates the quality of evidence, based primarily on the likelihood that evidence is biased. A powerful RCT is the best standard for evaluating the inherent bias, but it does not follow that EBM requires only RCTs to justify clinical practice. EBM requires that we attempt to audit our decisions by obtaining the highest level of evidence that is ethically or logistically possible [3, 11]. Rothoerl et al. [12] and Yarascavitch et al. [13] published investigations into the levels of evidence in the neurosurgical literature in 2003 resp. 2012. These studies assigned a level of evidence to all published clinical papers in 3 major neurosurgical journals for the years 1999 resp. 2009-2010. The authors found that 22.8% resp. 10.3% of the literature was higher-level evidence (Level I and II). Level I, RCTs with homogeneous results, were only 3.8% resp. 2.1%. It had decreased, but was still significant higher than what had been reported in some other surgical specialties, including general plastic surgery [14] and maxillofacial surgery [15]. However, neurosurgery is still lagging behind on many other specialties, including orthopaedics [16], ophthalmology [17], otolaryngology [18], aesthetic surgery [19], and urology [20].

Of the responders, 27.2% do not think or know if the treatment options they use, are based on high-quality evidence. Ducis et al. [6] investigated

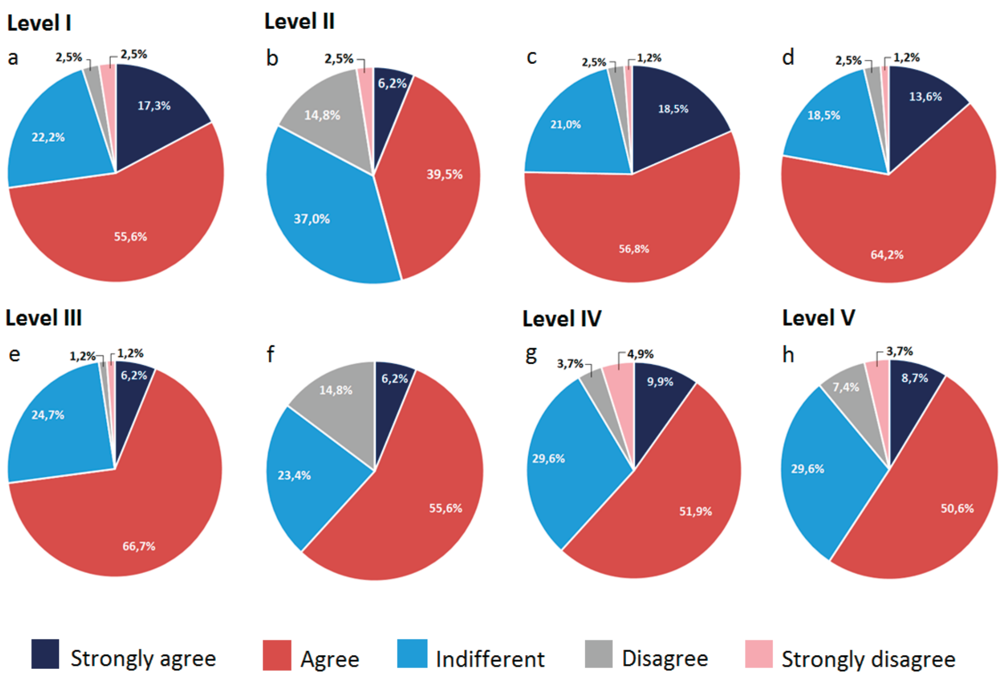

Figure 2: *Researches used by neurosurgeons in clinical practice: a) (Meta-analysis of) RCTs with homogeneous results; b) (meta-analysis of) RCTs with inconsistent, but promising, results; c) meta-analysis of prospective cohort studies; d) prospective cohort studies; e) (meta-analysis of) retrospective cohort studies; f) case-control studies; g) case series; h) case reports, expert opinions and/or personal observations. Results are presented on a five-item Likert scale ranging from (1) strongly agree, (2) agree, (3) indifferent, (4) disagree, to (5) strongly disagree.*

the quality of neurosurgery clinical practice guidelines. In neurosurgery, 24.4% of the guidelines are mainly based on Level I recommendations, which is statistically significant higher with neurosurgical vascular guidelines. Vascular neurosurgery is also the subspecialty with the highest publication rate in neurosurgery [13]. Some other specialties have similar Level I recommendations, including endocrinology [21], infectious diseases [22] and hepatology [23]. The proportion of Level I recommendations in these specialties have been ranging from 14.0%-22.4%. Almost half of the neurosurgeons, 49.4%, do think their specialty is based on less evidence compared to other specialties, but that seems contradictory with the literature available.

The difference in confidence regarding adequate interpretation of statistical outcomes presented in literature between those with and without formal training in EBM is also striking. Since evidence-based medicine is based on implementation of research results after correct interpretation, our results may be an argument to introduce formal EBM training in the medical curriculum.

Possible participants were all members of the EANS. EANS is an independent, supranational association of national European neurosurgical societies and individual members. The responders are a small selection of a large population of neurosurgeons that was addressed. This might introduce bias. It might introduce an underestimation of the real opinion, since only motivated or neurosurgeons trained in EMB could have responded. Participants did have the opportunity to give socially desirable answers. However and in our opinion, this was counteracted by emphasising the anonymity of the survey.

Lastly, the survey was made in Google Inc. Forms and therefore did not have the option to exclude more than one completed survey from the same IP address or have a login page. The login page from Google was not activated, so participants were not obligated to have a Google-account. All completed surveys were manually checked, so two identical surveys could be excluded. Furthermore, since this was a survey without any obligations we are convinced that nobody would feel the need to contribute more than once.

Conclusion

According to the responders, high-quality evidence is less frequent available in neurosurgery. The responders show they are willing to base their treatment options on the results of other studies than just RCTs. The results of the survey shows neurosurgeons think there is few high-quality evidence available in neurosurgery. It could be an important development to update the original idea of high-quality neurosurgery to match the opinions of the neurosurgeons today.

Also, less than half of neurosurgeons receive formal training in EBM. Training in EBM enhanced the ability of neurosurgeons to understand, criticise and interpret statistical outcomes in journals better. Therefore, more training in EBM is desirable for neurosurgeons to improve this ability in order to facilitate implementation of results into clinical practice.

Acknowledgments

I would like to express my thanks toprof. Dr. J.A. Grotenhuis for supporting the distribution of the web-based survey by the EANS. Also, I would like to thank Prof. Dr. G.P. Westert and Prof. Dr. M.M. Rovers for giving feedback on my work.

References

1. Carnwell R. Essential differences between research and evidence-based practice. Nurse Researcher. 2001;8(2):55-68
2. Rycroft-Malone J, Seers K, Titchen A, Harvey G, Kitson A, McCormack B. What counts as evidence in evidence-based practice? J Adv Nurs. 2004;47(1):81-90
3. Haines SJ. Evidence-based neurosurgery. Neurosurgery. 2003;52:36-47
4. Sackett DL, Rosenberg WMC, Haynes RB, Richardson WS. Evidence based medicine: what it is and what it isn't. BMJ 1996;312:71-72
5. Definition of evidence, Oxford English Dictionaries. 2017. Available at: https://en.oxforddictionaries.com/definition/evidence. Accessed at May 11th, 2017
6. Ducis K, Florman JE, Rughani AI. Appraisal of the quality of neurosurgery clinical practice guidelines. World Neurosurg. 2016;90:322-339
7. Goodman K. Ethics and evidence-based medicine: fallibility and responsibility in clinical science. Cambridge: Cambridge University Press; 2003
8. Haynes RB, Sackett DL, Guyatt GH, Cook DJ, Gray JA. Transforming evidence from research into practice: 4. Overcoming barriers to application (Editorial). APC Journal Club 1997;126:14-15
9. Rutka JT. Classes of evidence in neurosurgery. J Neurosurg 2016; July 1; 1-2
10. Page-Bucci H. The value of Likert scales in measuring attitudes of online learners. HKA Designs. Feb. 2003 – 20 Oct. 2007. Available at: http://www.hkadesigns.co.uk/websites/msc/reme/likert.htm. Accessed at June 1st, 2017
11. Bandopadhayay P, Goldschlager T, Rosenfeld JV. The role of evidence-based medicine in neurosurgery. J. Clin. Neurosci. 2008;15:373-378
12. Rothoerl RD, Klier J, Woertgen C. Level of evidence and citation index in current neurosurgical publications. Neurosurg Rev 2003;26:257-261
13. Yarascavitch BA, Chuback JE, Almenawer SA, Reddy K, Bhandari M. Levels of evidence in the neurosurgical literature: more tribulations than trials. Neurosurgery 2012;71(6):1131-1137
14. Loiselle F, Mahabir RC, Harrop AR. Levels of evidence in plastic surgery research over 20 years. Plast Reconstr Surg 2008;121(4):207-211
15. Lau SL, Samman N. Levels of evidence and journal impact factor in oral and maxillofacial surgery. Int J Oral Maxillofac Surg 2007;36(1):1–5
16. Obremskey WT, Pappas N, Attallah-Wasif E, Tornetta P 3rd, Bhandari M. Level of evidence in orthopaedic journals. J Bone Joint Surg Am. 2005;87(12):2632-2638
17. Lai TY, Leung GM, Wong VW, Lam RF, Cheng AC, Lam DS. How evidence-based are publications in clinical ophthalmic journals? Invest Ophthalmol Vis Sci. 2006;47(5):1831-1838
18. Wasserman JM, Wynn R, Bash TS, Rosenfeld RM. Levels of evidence in otolaryngology journals. Otolaryngol Head Neck Surg. 2006;134(5):717-723
19. Chuback JE, Yarascavitch BA, Eaves FF 3rd, Thoma A, Bhandari M. Evidence in the aesthetic surgical literature over the past decade: how far have we come? Plast Recontr Surg. 2012;129(1):126e-134e
20. Borawski RK, Norris RD, Fesperman SF, Vieweg J, Preminger GM, Dahm P. Levels of evidence in urological literature. J Urol. 2007;178(4 pt 1):1429-1433
21. Hazlehurst JM, Armstrong MJ, Sherlock M, Rowe IA, O'Reilly MW, Franklyn JA, Stewart PM, Tomlinson JW. A comparative quality assessment of evidence-based guidelines in endocrinology. Clin Endocrinol. 2013;78(2):183-190
22. Lee DH, Vielemeyer O. Analysis of overall level of evidence behind Infectious Diseases Society of America practice guidelines. Arch Intern Med. 2011;171:18-22
23. Rowe IA, Parker R, Amstrong MJ, King AL, Houlihan DD, Mutimer D. Assessment of the quality of evidence underlying international guidelines in liver diseases. Am J Gastroenterol. 2012;107:1276-1282