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Original Article

What do neurosurgical trainees think about neuro-interventional training and service provision in the United Kingdom?

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ABSTRACT

Background: There is a disparity between the number of interventional neuroradiologists (INRs) in the UK and the number needed to provide a comprehensive 24/7 interventional neurovascular service. It is recognized that trainees from other specialties such as neurosurgery may be able to provide INR services after appropriate training. At present gaining skills in INR is not a mandatory requirement of the neurosurgical training curriculum in the UK. The views on this issue of current neurosurgical trainees are unknown. We aimed to address this knowledge gap.

Methods: We performed an anonymized online survey to gauge the opinion of neurosurgical trainees about their attitudes to INR training and service provision.

Results: 90/265 (34%) UK neurosurgical trainees responded to the survey. About 56% of respondents reported they were likely or very likely to pursue interventional training if a curriculum was approved by the general medical council. About 80% thought training should take up to 2 years. About 90% of those very likely or likely to pursue INR wanted a hybrid neurosurgical practice and 92% were willing to provide endovascular services out of hours.

Conclusion: The responses described suggest that a significant proportion of neurosurgical trainees would pursue INR training and have realistic expectation regarding out of hours commitment and length of training.

Keywords: Aneurysm, Mechanical thrombectomy, Neuro-intervention, Neurovascular, Training

INTRODUCTION

Interventional neuroradiological (INR) procedures provide effective treatment for a variety of neurovascular disorders. 2016 marked a sea change for the future of INR service provision in the UK. Seven randomized controlled trials, (MR-CLEAN, ESCAPE, SWIFT PRIME, EXTEND-IA, REVASCAT, THRACE, and THERAPY), confirmed the role of mechanical thrombectomy (MT) for the treatment of ischemic stroke.[1-3,5,7,12,19] They randomized 1780 patients to either MT or standard care and demonstrated 29–86% improvement in odds of favorable functional outcome. National Health Service (NHS) England commissioned MT in 2017, hoping to benefit

8000 patients in the UK.[15] However, the availability of INR services is suffering a major shortfall. In 2017, there were only 90 trained INRs working in 28 neuroscience centers in the UK; which was not sufficient to provide a comprehensive national MT service.[17] To the best of our knowledge, only two centers in the UK, and none outside of London, are adequately staffed to provide a sustainable 24/7 MT service. There is also evidence that patients with other indications for INR procedures, such as aneurysmal subarachnoid hemorrhage, have poorer outcomes when admitted out of hours.[4] To bridge this gap suggestions have been made to offer neuro-intervention training to non-radiologists.[9] However, concerns have been raised regarding delivering adequate after-care outside of a clinical neurosciences environment.[6]

At present the typical route to practice as an INR in the UK begins with undertaking specialty training in clinical radiology lasting 3 years (ST1-3).[11] This is followed by sub-specialty training in interventional radiology lasting an additional 3 years where candidates can choose to develop skills in diagnostic and INR (ST4-6). On completion of this stage, the clinician is awarded certificate of completion of training (CCT) in clinical radiology with INR sub-specialization. It is not uncommon to undertake a fellowship program post-CCT to gain further experience in INR.

Neurosurgery routinely involves interpretation of complex brain imaging and neurosurgeons routinely provide post-procedural care to patients undergoing INR procedures. In many countries outside the United Kingdom, hybrid neurosurgeons perform endovascular and open neurosurgical techniques. Neurosurgical training in the UK in most part consists of 8 years of standardized training years (ST1-8) leading to CCT. So far, the role of INR training in this curriculum is yet to be determined. Gaining skills in INR procedures are not mandatory for neurosurgical training; however, endovascular cases can be included in a trainee's logbook. At this important time, the attitudes of UK neurosurgical trainees to learn and provide neuro-interventional procedures are unknown and could be important for planning the future INR workforce. We surveyed neurosurgical trainees to understand their attitudes to INR training and service provision.

MATERIALS AND METHODS

A nine-part questionnaire was designed and distributed using SurveyMonkey® and through departmental WhatsApp® messaging software, the email subscription list of the British Neurosurgical Trainee Association and Society of British Neurological Surgeons. Results were compared between those very likely, or likely to undertake INR versus those who were not, using Pearson's Chi-square on SPSS software Version 23.0 (IBM, New York). Statistical significance was defined by $P < 0.05$.

RESULTS

Ninety neurosurgical doctors below level of consultant responded to the survey [Figure 1]. There are 265 UK neurosurgical trainees returning a response rate of 34%. About 27% (24/90) of respondents were ST1; however, there was no statistically significant difference between the numbers of respondents ST1-4 versus ST5-CCT. Respondents expressed a range of specialty preferences with neuro-oncology and vascular neurosurgery expressed as top choice subspecialty, both at 23% (21/90) each. The bottom choice specialties reported in the survey were functional neurosurgery and traumatology with 31% (28/90) and 20% (18/90) of candidates indicating so, respectively.

About 56% (50/90) of the sample reported they would be very likely or likely to pursue INR training if a curriculum was approved by the general medical council or royal college of surgeons. About 51% (46/90) of respondents had already had experience of INR procedures: About 48% (43/90) had observed INR procedures while 3% (3/90) had conducted INR audit or research. The point at which INR training should take place was distributed evenly. About 38% (34/90), 26% (23/90), and 37% (33/90) of respondents thought INR training should take place before CCT, after CCT or either before or after CCT, respectively. Most respondents thought INR training should take 1–2 years. As consultants, 34% (31/90) of respondents would offer INR services even if it added to their out of hours commitment. About 46% (41/90) of respondents would offer INR services only if their out of hours commitment stayed the same. About 20% (18/90) of respondents would not offer INR services out of hours.

About 34% of trainees stating they were very likely or likely to pursue INR training indicated vascular neurosurgery as their top choice specialty compared to 10% in respondents not interested in INR training ($P = 0.005$). These trainees were also more likely to have experience of INR with 33% (30/90) reporting having observed INR procedures compared to only 14% (13/90) in those who were not interested in INR training ($P = 0.01$).

General comments shared by respondents indicated that mandatory INR experience should be introduced into neurosurgical training [Table 1]. Many respondents noted that neurosurgical training in other countries includes gaining competences in INR. The comments provide further evidence that neurosurgical trainees are interested in providing a MT service to fulfill the service provision needs of the UK; however, trainees also recognize there is a need for more clinicians who can provide INR services. In particular, the comments suggest that neurosurgical trainees have an appetite to train in endovascular coiling of aneurysms to treat conditions such as aneurysmal subarachnoid hemorrhage and in endovascular procedures to treat other neurovascular pathologies.

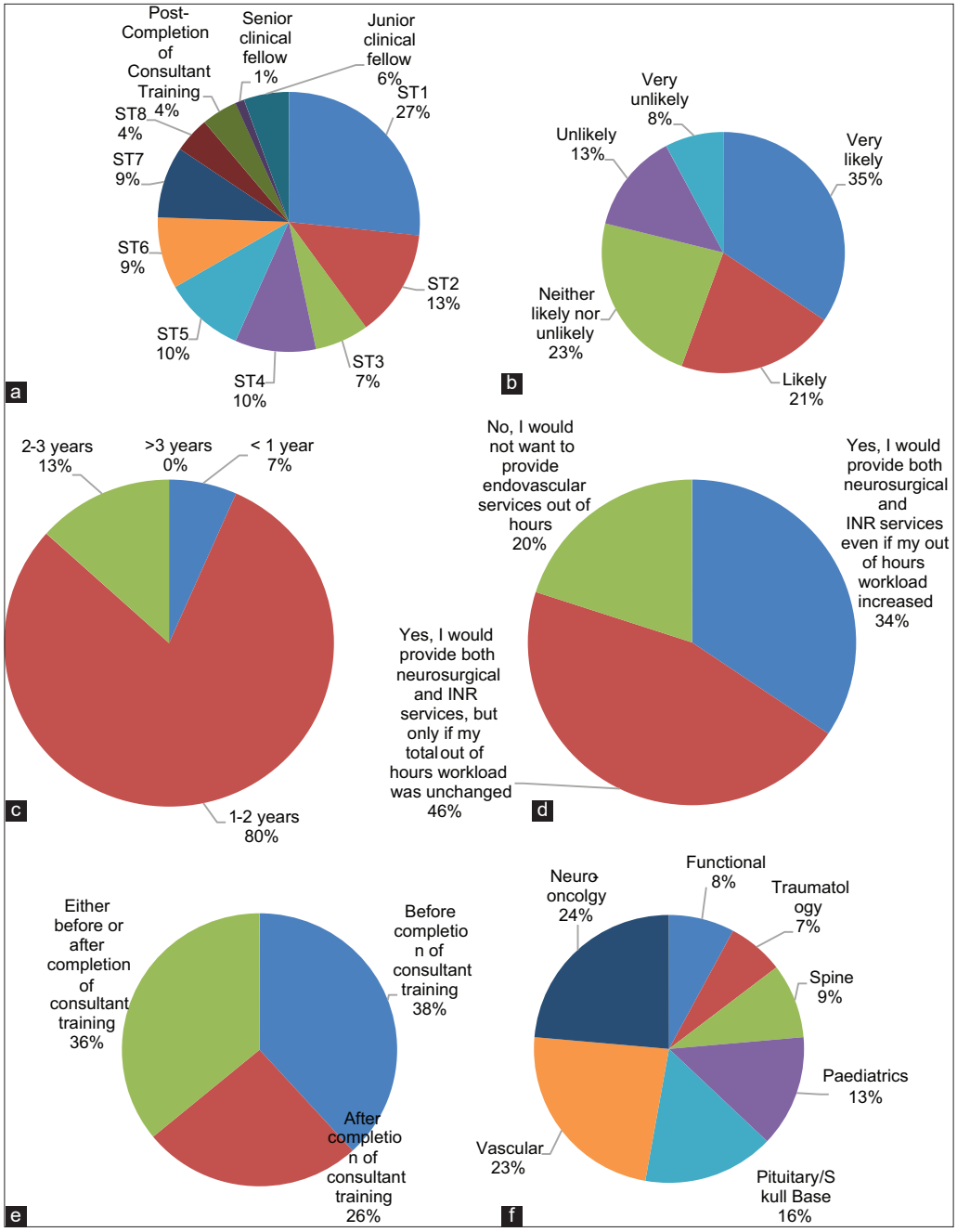

Figure 1: Results of a nationwide survey regarding trainees' attitudes to interventional training and service provision in the UK. a) What grade are you? b) How likely would you be to pursue INR training with an approved curriculum? c) How long do you think an INR fellowship should be? d) Would you be willing to provide INR services out of hours? e) Do you think INR training should take place before or after completion of consultant training (CCT)? f) What is your top subspecialty interest?

DISCUSSION

We present the attitudes of current UK neurosurgical trainees to INR training and service provision. Trainees from a range of specialties and grades expressed interest in pursuing INR training. Many of the respondents had already tried to gain exposure to INR either by observation, research or audit. About 92% of this group were keen to offer INR services out of hours.

There are various limitations to this survey. There are 265 neurosurgical trainees in the UK and the survey was completed by 90 trainees returning a response rate of 34%. This sample may over-represent those interested in INR, nevertheless the Royal College of Radiologists estimates a further 50 endovascular specialists are needed to meet expected demand.[17] The interest expressed by

Table 1: Selected opinions of neurosurgical trainees regarding Interventional Neuroradiology training and service provision in the UK.

Comments provided by respondents
INR should be considered as an integral part of training.
Time to train before completion of consultant training would be difficult.
In countries like India where I was trained, INR is part of training and if one wants to pursue INR, he/she undergoes further training by doing a fellowship and then can work as INR. In fact, more neurosurgeons are working as INR than radiologists. So I think it's about time UK should consider this.
Every trainee should have a 6-month block or rotation in INR during training.
I think it is very important for the same provider to do both operative and endovascular interventions to be able to make an informed decision about the management of a clinical case.
It's a growing need so both neurosurgeons and radiologists should do it.
Should certainly include coiling as well as thrombectomy.
I think it would be a great opportunity to learn INR skills. It would useful for a neurosurgeon interested in vascular. Having INR skills could improve your decision making for vascular patients.
I think it is a very good idea. However, vascular neurosurgery is not for me generally.
Although I am not personally interested in INR training as I have no vascular interest I strongly feel this should be part of the training of those now coming through.
INR training should be available and easily accessible to any neurosurgery trainee. I am not sure it will be possible to be a hybrid neurovascular surgeon with a surgical and endovascular practice due to the demands of acquiring the skill set in either practice.
I think as services are planned for the future, a 24 h coiling service will be needed and that means we need to be able to do them. This is definitely a skill that should be a part of our training and built into the curriculum.
There needs to be an integrated curriculum of interventional neuroradiology for neurosurgical trainees. Formal program for training should include: Courses in radiological anatomy, principals of application of multimodality radio-diagnostics, and interventions, hands-on cadaveric and simulated neuroradiological interventions, practical training of an adequate number of diagnostic angiographic followed by interventional procedures, evaluation of competence, and certification of competence.
I think it's important for our future generations of vascular neurosurgeons that they are able to do both techniques because of common and interconnected ground for both.
I think this is a valuable aspect of Neurosurgical training. Many units in the world have successfully trained their Neurosurgery Trainees with INR.

INR: Interventional neuro-radiological

our respondents could make a substantial contribution in achieving this target if neurosurgical trainees are permitted to acquire endovascular competency. Fifty neurosurgical trainees reported that they would be very likely or likely to pursue INR training; this alone could make a significant contribution to a MT service. ST1s were the most common grade to respond to the survey and most trainees were between grades ST1 and ST4. It is possible that attitudes toward INR training may change as trainees approach CCT.

Most trainees agreed that INR training should take 1–2 years. This is not dissimilar from the length of endovascular training programs in other countries. The USA recommends a total of 1 years' training for INR skills while European countries and Australasia recommend around 2 years.[9] Although imaging interpretation is an essential part of training, it must be acknowledged that neurosurgeons do not possess the same foundations in clinical imaging as radiologists. The additional interpretive, reporting, and interventional skills required to develop INR competencies will be a key challenge for the design of a future curriculum.

Endovascular treatment is an essential part of modern stroke care. Globally, subarachnoid hemorrhage accounts for 8.9% of the total stroke burden and leads to considerable disability and mortality.[8] Endovascular coiling of aneurysmal subarachnoid hemorrhage can reduce risk of dependency and death.[13,14] The NHS spends an estimated total of £168.2 million per annum to treat aneurysmal subarachnoid hemorrhage with the average cost per patient estimated to be £23,294.[16] The average inpatient cost of endovascular coiling versus neurosurgical clipping to treat aneurysmal subarachnoid hemorrhage is comparable, but shorter operating time and shorter length of hospital stay after the endovascular procedure may still confer financial savings.[20] Indeed, in the context of ischemic stroke which directly costs the NHS approximately £4 billion per annum, Lobotesis *et al.* demonstrated that the higher treatment costs of stent-retriever thrombectomy were offset by long-term cost savings due to improved patient health status.[10,18] This led to overall savings of £33,190 per patient. Considering the potential long-term cost-effectiveness of endovascular procedures, expanding INR capability may be of considerable benefit particularly in publicly funded health-care systems.

The arrival of MT heralds an exciting time for the future of INR in the UK. This survey suggests that a significant proportion of trainee neurosurgeons would be keen to pursue INR training. Pertinent issues for neurosurgeons include what further training in non-interventional radiology would be required and how neurosurgeons could offer INR treatment for cerebral aneurysms as well as MT.

CONCLUSION

A considerable proportion of neurosurgical trainees in the UK are interested in pursuing INR training and have potential to provide neuro-interventional care. They have

realistic expectation regarding out of hours commitment and length of training. If neurosurgical trainees are permitted to acquire endovascular competency they could make a substantial contribution to the UK's INR services.

Declaration of patient consent

Patient's consent not required as patients identity is not disclosed or compromised.

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Conflicts of interest

There are no conflicts of interest.

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