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DOCENDO AC DISCENDO

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Foreword

A Message from the Chief Medical Officer for England, United Kingdom

The systematic and safe acquisition of high quality clinical skills is an essential part of modern medical training as highlighted in my Annual Report published in March 2009. I wish the International Journal of Clinical Skills every success in highlighting research and knowledge in this important area.

Sir Liam Donaldson
The Chief Medical Officer for England

Accuracy of neurological diagnosis in the emergency department

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Abstract

Inaccurate diagnosis of neurological presentations in the emergency department is a well characterised problem. Reliable diagnosis is important because it leads to the initiation of appropriate management plans and enables the correct use of increasingly available emergency interventions (e.g. thrombolysis in acute ischaemic stroke). Correctly identifying benign conditions can prevent the patient being exposed to unnecessary and potentially harmful investigations and treatments for more serious problems. Furthermore, neurological diagnoses such as epilepsy can enforce lifestyle limitations and thus it is crucial that such diagnoses are not made erroneously.

This paper discusses factors that predispose to incorrect diagnosis and looks at studies that have suggested various ways of improving diagnostic reliability.

Introduction

The evaluation of neurological symptoms accounts for a significant part of the workload of emergency physicians. An American survey found that at least 15% of emergency department (ED) admissions are due to neurological problems [1]. In the UK emergency physicians and general practitioners form the front line in the assessment of neurological presentations.

Given the relative complexity of neurological assessment, often with a lack of corroborative investigations, it is crucial that the doctors evaluating patients can reach accurate clinical diagnoses. Considering that these doctors are not formally trained at length in neurology, it is important to assess and validate their clinical skills.

Assessing the accuracy of emergency neurological diagnosis
Performing Medline searches using combinations of the terms 'neurological disease', 'emergency department', 'diagnostic accuracy' and 'clinical skills' revealed several studies that have explored the matter in question. Most of these focused on specific presentations, the most widely studied of which was stroke; the latter due to recent advances in emergency intervention for stroke – the implementation of which depends pivotally on an accurate diagnosis [2].

Only two studies reported a general assessment of neurological diagnosis in the emergency department [3, 4]. These have shown that accuracy varies according to the particular diagnosis and depends on a multitude of other factors.

Moeller and colleagues [3] examined all the referrals made from the emergency department to the neurology service at a Canadian university hospital. They compared the diagnosis made by the emergency physician to the 'final' diagnosis made by the neurologist to whom the patient was referred. In summary, they found that the emergency physician's diagnosis agreed with the neurologist's final diagnosis in 60.4% of cases (n=493). In 19.1% of cases, the emergency diagnosis was completely different to the final diagnosis. This study [3] then went on to divide the results according

to specific conditions in order to identify the most frequently misdiagnosed. They report that emergency physicians had a tendency to over diagnose stroke and seizures; these were proposed in 71% of the cases where the emergency physician's diagnosis disagreed with the final diagnosis. Following neurological review, the final diagnoses turned out to be generally more benign, with migraine, neurocardiogenic syncope and vestibular neuronitis emerging as common final diagnoses instead of seizures and stroke.

A similar study, conducted in a French teaching hospital [4], found that 52.5% of tentative diagnoses made by emergency department (ED) physicians were overturned following neurological review. These 'tentative diagnoses' were made before the use of corroborative investigations. The false positive and false negative rates for ED diagnoses were 37.3% and 36.6% respectively (n=1,679). This study was run over a 12 month period with a neurologist based in the emergency department, reviewing cases seen by the ED physicians. They found that the most errors were made in diagnosing stroke, confusion or coma. Migraine, status epilepticus and global transient amnesia were the most precisely diagnosed.

Both studies have numerous limitations. For example, the 'final diagnosis' is not necessarily definitive as most often there are no 'gold-standard' tests to confirm the diagnosis. Secondly, looking at clinical diagnosis in isolation, without supplementary investigations, is an artificial situation which would not reflect regular emergency department practice.

Factors affecting accuracy
In addition to the underlying conditions, these studies showed that a host of other factors can contribute to the accuracy of ED diagnosis. Moeller and colleagues [3] report a tendency to over diagnose serious conditions such as stroke and seizures. They interpret this as erring towards the side of patient safety and ensuring that the patient gets the appropriate tests to rule out the serious diagnosis. This is an intrinsic and important part of the rationale of any emergency department.

Not surprisingly, the training level and experience of the ED doctors has a statistically significant effect on diagnostic accuracy, with trainees producing accurate diagnoses less often than senior ED physicians (57% and 66% correct respectively) [3], with the trainees also expressing a higher degree of diagnostic uncertainty.

One might consider that diagnostic accuracy could vary between ED physicians working in teaching hospitals and district generals. Given easier access to specialist services at large teaching hospitals, would these doctors be better placed at making neurological diagnoses? The only available studies addressing this issue were focused on stroke. Several large trials have evaluated the accuracy of ED physicians in diagnosing stroke [2, 5, 6]. The earlier trials [2, 5] were carried out at academic centres in the USA (equivalent to UK teaching hospitals). Kothari and colleagues [2] reviewed 446 patients with an admitting diagnosis of stroke in the ED and compared this diagnosis to their final diagnosis at discharge, made by a neurologist or neurosurgeon. They found that these ED physicians were correct 95 out of 100 times when identifying patients with TIA or stroke. In 2004 Morgenstern and colleagues confirmed that ED physicians based in non-academic hospitals

were also accurate in identifying acute cases of stroke (accuracy of 90%). Although this is 5% less than the result obtained by the previous report [2], this probably reflects methodological differences and the authors of the later study explicitly conclude that there is not a remarkable difference in accuracy.

The identity of the underlying condition impacts on accuracy of diagnosis, as has been explored above. Furthermore, even within a diagnostic class, particular features of the presentation can affect accuracy. Morgernstern and colleagues reported that different types of stroke caused different amounts of disagreement between the ED physicians and neurologists. ED physicians were less accurate in diagnosing vertebrobasilar strokes than those affecting the anterior circulation. They were less likely to miss strokes that presented with motor or language related symptoms and signs, whereas the presence of a previous history of stroke increased the odds of a false positive diagnosis of stroke [6].

In addition to those focused on stroke, there are several papers exploring diagnostic accuracy in other conditions, including subarachnoid haemorrhage (SAH) in the ED [7, 8]. Earlier studies showed that up to one third of cases were misdiagnosed [7] with highest rates of error when the haemorrhage was small and in patients with a normal conscious level. In this study, the high rate of error was attributed to a failure in recognising the full range of presentations of SAH, placing too much value on the CT scan and misinterpretation of lumbar puncture results. The authors quote poorly timed CT scans and over-diagnosing 'traumatic taps' as specific reasons for missing SAH. A later study [8] reported lower rates of misdiagnosis than originally proposed, perhaps reflecting the effects of improved education and research.

A general, perhaps obvious trend that emerges from studies on stroke, SAH and status epilepticus is that cases with more subtle clinical features tend to be missed. Diagnosis of tonic-clonic status epilepticus is straightforward and diagnosed accurately in the ED, whereas other seizures, with less obvious manifestations, such as eyelid or finger twitching, might understandably be missed by someone without formal training in neurology [9].

Can diagnostic accuracy be improved?
In general, diagnostic errors in the ED are due to a combination of educational deficiencies and insufficient specialist support [9]. The studies discussed so far have delineated factors that predispose to diagnostic errors, and have highlighted the effectiveness of training and experience in improving clinical diagnostic skills [3]. Can these findings be implemented in order to improve diagnostic accuracy? The four main strategies are as follows: to improve clinical skills training, to increase the availability of specialist support, to have reliable diagnostic protocols and finally to have dedicated specialist centres.

The training of ED doctors could be improved at a pre-specialist level (e.g. at medical school or as foundation doctors in the UK) or during speciality training schemes. Past studies have identified areas where additional teaching could be directed. For example, Moeller and colleagues [3] identified that differentiating neurocardiogenic syncope, vestibular neuronitis and migraine from strokes and seizures was a particular problem area. This could be dealt with by giving neurologist-led teaching to doctors training to work in the emergency department. The neurologists, with their outpatient experience in these benign conditions, could teach a useful approach to such diagnoses.

A feature of the newly conceived plans for UK foundation training is continued assessment of clinical skills via clinical encounter exercises (mini-CEX) and case-based discussions (CBD). One way of improving the quality of neurological diagnosis might be to incorporate neurological patients into these exercises, thus assessing and validating the diagnostic ability of each trainee.

When focusing more on specialist training, an alternative would be to allow ED doctors to rotate through neurology as part of their training, in the hope that they gain the experience necessary to hone their diagnostic skills. However, emergency medicine is a broad field and there are numerous other disciplines which will compete with neurology for time in ED training programmes. In America, one third of emergency medicine training programmes incorporate some neurological experience [10].

Moulin and colleagues [4] explored the second strategy: to increase the availability of specialist support in the emergency department. They arranged for all patients in the emergency department with neurological problems to be seen by an on-call neurologist in addition to the ED team. The neurologist was informed of the tentative diagnosis of the ED team and the key features of the history and examination. The input from the neurologist led to a positive contribution in 87.6% of cases, with a total change of diagnosis in 52.5%. The authors recommend their study protocol for wider implementation, as it proved to be effective in improving diagnostic accuracy in the ED. However, this option would not be viable in the UK where current neurologists are already under tight time constraints and there is a national shortage of neurologists [11].

A more feasible alternative might be to ensure the availability and encourage regular use of telephone consultations with a neurologist [2]. Early investigations suggest that advice from neurologists over the phone can improve diagnosis of stroke [9]. Potential problems identified by American studies include devising means of providing quality assurance [12].

Formulating specific protocols is a third possible way to improve accuracy of diagnosis. Certain presentations are clearly more amenable to such an approach than others. Using protocols in stroke diagnosis has led to improved recognition of stroke and appropriate use of thrombolysis [13]. Similarly, diagnostic criteria have been proposed for headache in the emergency department to reduce the variability in the management of these patients [14].

The final identified strategy would be to open up units that specialise in particular neurological emergencies. This has worked immensely well with stroke, where the stroke unit has optimised acute and subsequent care of stroke patients. With its high prevalence, stroke is the only condition for which such an approach can be justified.

Conclusions

The fact that the emergency management of neurological conditions is not delivered by doctors that specialise in neurology creates inevitable difficulties. Inaccurate diagnosis of neurological presentations in the emergency department is an important and well characterised problem and arises

because of insufficient specialist support and deficient clinical skills education. Studies to date have demonstrated factors that predispose to incorrect diagnosis and have suggested various ways of improving diagnostic reliability in the ED. There is no solution lacking limitations or expenses – misdiagnosis is therefore likely to remain as a significant problem in the foreseeable future.

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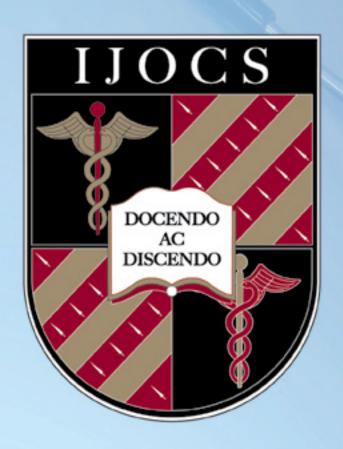9. Manno E M. (2008). Safety issues and concerns for the neurological patient in the emergency department. Neurocritical Care. 9(2):259-264.
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