

Atraumatic needles for lumbar puncture: why haven't neurologists changed?

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ABSTRACT

Diagnostic lumbar puncture is a key procedure in neurology; however, it is commonly complicated by post-lumbar puncture headache. Atraumatic needle systems can dramatically reduce the incidence of this iatrogenic complication. However, only a minority of neurologists use such needles. In this paper, we discuss possible reasons why neurologists have not switched to new technology, looking more at diffusion of innovation rather than lack of evidence. We suggest ways to overcome this failure to adopt change, ranging from local interventions to patient empowerment.

THE CASE FOR ATRAUMATIC DIAGNOSTIC LUMBAR PUNCTURE

Diagnostic lumbar puncture is a key procedure in neurology as well as other medical disciplines. Quincke carried out the first lumbar puncture in 1891.¹ It is generally safe but a common complication is post-lumbar puncture headache syndrome² caused by the iatrogenic cerebrospinal fluid (CSF)³ leak. The occurrence the headache syndrome depends largely on the type of needle used. Numerous studies have shown that frequency and severity of post-lumbar puncture headache syndrome can be dramatically reduced by replacing traumatic needles with atraumatic systems⁴ (figures 1 and 2). Using the MeSH (medical subject headings) terms 'lumbar puncture', 'headache', 'atraumatic' and 'spinal needle', we identified 11 studies that compared the incidence of post-lumbar puncture headache following diagnostic lumbar puncture when using atraumatic versus traumatic spinal needles. All studies showed a lower incidence from using atraumatic spinal needles (table 1).^{5–13}

A meta-analysis of 38 studies across a wider population confirms a significantly

lower rate of post-lumbar puncture headache. A subgroup analysis in the same study showed an even lower incidence of headache following atraumatic lumbar puncture in people undergoing the procedure for diagnosis rather than for anaesthesia.⁴ Earlier suggestions that atraumatic needles would have lower CSF flow rates and would impair pressure measurements have been invalidated.¹⁵ Finally, recent evidence confirmed the clinical effectiveness and the cost-effectiveness of switching to atraumatic spinal needles for diagnostic lumbar puncture.¹⁶

However, despite the overwhelming evidence favouring atraumatic (rather than traumatic) lumbar puncture, and practice guidelines from the American Academy of Neurology,¹⁷ neurologists around the world continue to dither about adopting this over 60-year-old 'innovation'.^{18–19} For example, a recent survey of UK neurologists showed that while 74% knew that atraumatic needles can significantly reduce the risk of post-lumbar puncture headache syndrome, only 16% were actually using them.⁵ By contrast, anaesthetists consider the use of atraumatic needles to be the norm and continued use of traumatic needles to be ethically unacceptable.²⁰

The question therefore arises: why are neurologists so reluctant to adopt atraumatic needles? We argue that the 'failure to switch' from one needle type to another has very little to do with the evidence, which is strikingly favours atraumatic needles. The explanation is more likely in the way that this innovation has been communicated—'diffused' as Everett Rogers²¹ calls it—among neurologists. We explore this hypothesis and propose suggestions on how to overcome this innovation deadlock.

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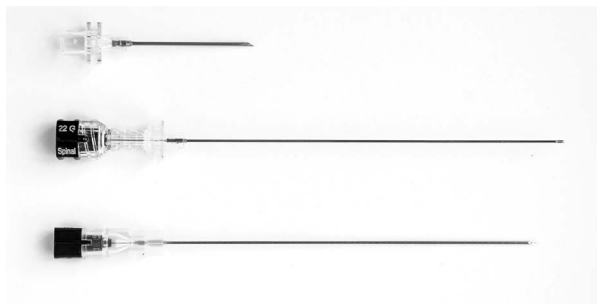


Figure 1 Overview of spinal needle types showing the atraumatic 'pinpoint' spinal needle (middle) with introducer (top), and traumatic 'cutting' spinal needle (bottom).

RECOGNISING THE BENEFITS OF ATRAUMATIC LUMBAR PUNCTURE

According to Rogers, for an innovation to be adopted, there must be a recognisable benefit.²¹ The non-adoption of atraumatic needle suggests a lack of awareness of the morbidity associated with post-lumbar puncture headache. The qualitative data support this impression, indicating that most UK neurologists believe that post-lumbar puncture headache occurs 'rarely'. This is also reflected in the wealth of patient information sheets that describe post-lumbar puncture headache as a rare and mild complication, despite the overwhelming evidence to the contrary.^{22–24} We propose a root cause of the discrepancy between evidence and awareness is the disconnect between those colleagues performing lumbar punctures and those who subsequently review patients with their post-procedure headache; the investigation is often performed in an outpatient or day-case setting, with patients leaving hospital soon afterwards. By the time they develop post-lumbar puncture headache, most

have returned home and so present to their general practitioner rather than the hospital.

MYTH-BUSTING: THE 'COMPLEXITY' OF ATRAUMATIC LUMBAR PUNCTURE

The complexity of an innovation affects the likelihood of its adoption.²¹ There is a common perception among neurologists that using atraumatic lumbar puncture systems is more complex than using traumatic needles.⁵ However, the evidence suggests that the learning curve between atraumatic and traumatic lumbar puncture is no different.¹¹ After completing a training session using a simulator, 92% of neurology residents indicated that they would use atraumatic needles again in their first lumbar puncture in a patient.²⁵ Our group has shown no difference in the number of attempts using either needle system between two operators, one of whom had previously used only traumatic needles, while the other had used atraumatic needles from the outset.⁵

AUSTERITY AND MULTI-PROFESSIONALISM IN PUBLIC HEALTHCARE AS BARRIERS TO CHANGE

Financial pressures in public healthcare encourage us all to identify potential savings. Atraumatic needle systems cost three times as much as standard traumatic needles (in the UK, £9.47 vs £3.42). However, analysis of the total financial burden of diagnostic lumbar puncture—including the management of post-lumbar puncture headache syndrome—shows that atraumatic systems are clearly more cost-effective.^{5 16} Doctors performing lumbar punctures may not know of the medical problems they may be causing, but commissioners should be more aware of the respective cost implications. However, with one needle type costing three times as much as the other, and with savings on the total cost of the procedure either not assessed or not obvious, a narrow hospital-focussed financial view continues to determine which needle type to purchase. The result is the oft-quoted 'unavailability' of atraumatic needles on hospital wards and in clinics.⁵

BOUNDARIES BETWEEN CLINICAL COMMUNITIES AS BARRIERS TO CHANGE

We also need to consider how the evidence for atraumatic needles is communicated among neurologists, particularly compared with anaesthetists, where their use is standard. It was an anaesthetist who published the first study in *Anaesthesiology* in 1949, showing a reduction incidence of headache following use of atraumatic needles.²⁶ There has since been a wealth of evidence in both neurological and anaesthetic journals.^{2–13 26–31} Rogers describes how 'heterophilous communities' (eg, neurologists and anaesthetists), show slower rates of adoption than those where innovators and early adopters share the same role as those they subsequently influence.²¹ This may

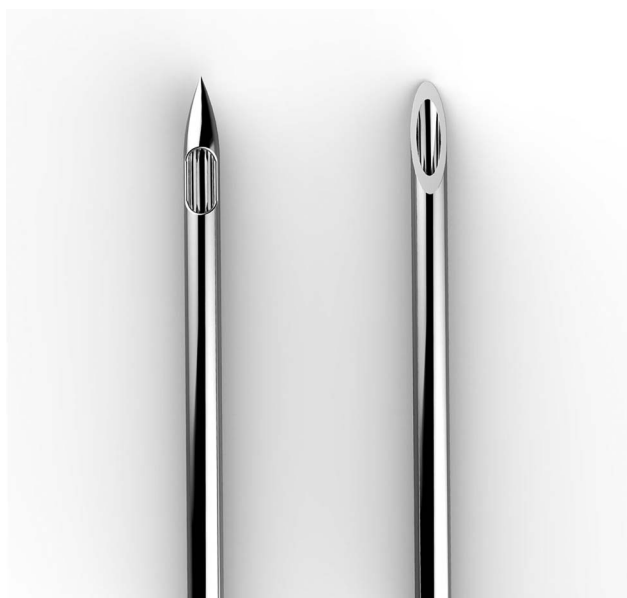


Figure 2 The needle tip in the atraumatic 'pinpoint' needle (left) and traumatic 'cutting' needle (right).

Table 1 Studies comparing incidence of post-lumbar puncture headache when using atraumatic and traumatic needles

Reference	Patient group	Study type	Incidence of post-lumbar puncture headache
Braune and Huffman ⁶	n=75	Prospective, double-blind clinical trial	Traumatic needle 36% atraumatic needle 4%
Kleyweg <i>et al</i> ⁷	n=99 traumatic needle=50 atraumatic needle=49	Double-blind randomised trial	Traumatic needle 32% atraumatic needle 6%, p=0.001
Strupp <i>et al</i> ⁸	n=230 traumatic needle=115 atraumatic needle=115	Prospective, randomised, double-blind study	Traumatic needle 24.4% atraumatic needle 12.2%, p<0.05
Torbati <i>et al</i> ⁹	n=317 traumatic needle=54.6% atraumatic needle=45.4%	Retrospective review	Traumatic needle 11.32% atraumatic needle 4.48%, p=0.017
Luostarinen <i>et al</i> ¹⁰	n=78 traumatic needle=39 atraumatic needle=39	Prospective, randomised study	Traumatic needle 49% atraumatic needle=36%, not significant
Vakharia and Lote ¹¹	n=52 traumatic needle=24 atraumatic needle=36	Retrospective (traumatic needle) and prospective (atraumatic needle)	Traumatic needle 10% atraumatic needle 8%, p<0.01
Jager <i>et al</i> ¹²	Atraumatic needle=600	Prospective	Atraumatic needle 3.6%
Hammond <i>et al</i> ¹³	n=187 traumatic needle=130 atraumatic needle=57	Prospective	Traumatic needle 32% atraumatic needle 19%
Thomas <i>et al</i> ¹⁴	n=97 traumatic needle=48 atraumatic needle=49	Double-blind randomised trial	Risk of headache with atraumatic needle reduced by 26% (95% CI 6% to 45%)
Lavi <i>et al</i> ²	n=55 traumatic needle=26 atraumatic needle=29	Prospective, randomised trial	Traumatic needle 36% atraumatic needle 3%, p=0.002
Davis <i>et al</i> ⁵	n=96 traumatic needle=48 atraumatic needle=48	Prospective observational study	Traumatic needle 50% atraumatic needle 20.9%, p=0.01

This excludes studies of children and patients undergoing either therapeutic lumbar puncture or epidural anaesthesia.

explain the difference between specialities. Even when excluding the interspeciality lag between anaesthetists and neurologists, the adoption rate of atraumatic needles still appears to be much slower among neurologists.^{5 18 32–34}

DIFFERENCES IN MEDICAL PRACTICE AND TRAINING AS BARRIERS TO CHANGE

The dissemination of evidence to underpin changes in clinical practice does not rely on peer-reviewed publications and on communication and training among colleagues within a speciality. The procedure-based nature of anaesthetics with its emphasis on ‘elbow-to-elbow’ training may well have facilitated the diffusion and adoption of atraumatic needles. Rogers suggests the rate of adoption within a community follows a bell-shaped curve. If the cumulative number of adopters is plotted, the result is an S-shaped curve. This S-shaped curve rises slowly at first, when there are only a few adopters in each time period, but then accelerates before eventually levelling out to a ‘tipping point’ in adoption. Rogers outlines adopter categories and describes progression along the curve as depending on dissemination of information and practice across these categories, within which individuals possess a different threshold for innovation.²¹ Others have argued that dissemination within healthcare systems takes less of a linear format.³⁵ Are anaesthetists more venturesome than neurologists, or does the nature of the speciality where procedural proficiency forms a critical part of training account for this difference?

MAKING DIAGNOSTIC LUMBAR PUNCTURES FINALLY ATRAUMATIC: SUGGESTIONS TO OVERCOME BARRIERS

The common denominator of the barriers to switch from traumatic to atraumatic diagnostic lumbar puncture as standard in neurology is a distinct lack of communication. Doctors need to know the evidence and act on it. To act they need to be trained in atraumatic lumbar puncture, and pass their knowledge and skill on to trainees, and perhaps to some seniors too. Commissioners need to be aware of the real cost of lumbar puncture, and neurologists should actively engage in translating the evidence in favour of atraumatic needles. Where traumatic needles are still used,



Figure 3 Patient information cards with the ClinicSpeak weblink, for patients awaiting diagnostic lumbar puncture. We can provide a sample pack of these cards on request.

and commissioners need 'local' evidence to convince them, audits comparing the two needle systems can provide the required information.

Finally, patients should be encouraged to seek information and to choose the needle type for their lumbar puncture. The 'clean hands campaign' of the National Patient Safety Agency tried to reassure patients; 'it's OK to ask' clinicians to wash their hands.³⁶ This could serve as a model for patients to request an atraumatic needle for their lumbar puncture. We have developed a simple web-based tool for patients to read before their lumbar puncture, including information about the benefits of atraumatic needle for their lumbar puncture: <http://www.clinicspeak.com/LumbarPuncture/> (figure 3).

Key points

- ▶ There is overwhelming evidence to support the use of atraumatic needles to reduce complications in diagnostic lumbar puncture; despite this, few neurologists have adopted this 60-year-old 'innovation'.
- ▶ Potential barriers to adoption include the communication of the evidence to commissioners who may not appreciate the overall cost savings; clinicians have a responsibility to ensure that those who procure our medical equipment know the evidence surrounding it.
- ▶ Lack of training opportunities may account for the perceived technical difficulties oft-quoted by neurologists resisting 'making the switch'; sharing good practice and communicating between neurology and anaesthetics—where atraumatic needles are standard—should help training and adoption.
- ▶ The patient champion has a role in influencing change of practice; a web-based information resource <http://www.clinicspeak.com/LumbarPuncture/> encourages patients to ask about spinal needle type.

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