

In this article...

- Anatomy of the lumbar spine
- Technique used for lumbar puncture
- Benefits of training advanced nurse practitioners to perform lumbar puncture

Training advanced practitioners to perform lumbar puncture

Key points

Lumbar puncture consists of inserting a needle in the spinal canal to take a sample of cerebrospinal fluid

Lumbar puncture helps diagnose neurological conditions and is a highly skilled procedure

Lumbar punctures used to fall under the remit of junior doctors

Advanced nurse practitioners can train to gain competence in lumbar puncture and go on to train junior doctors

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Abstract Lumbar puncture, a diagnostic procedure often undertaken in acute medical units, is a technical procedure that requires skill, knowledge and experience. Lumbar punctures used to be performed mostly by doctors but, today, nurses in advanced roles can perform them, as long as they receive the necessary training and are adequately assessed. This article describes how advanced nurse practitioners at Aintree University Hospital have expanded their role to include performing lumbar puncture and the benefits for patients and medical colleagues.

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Lumbar puncture traditionally fell under the remit of junior doctors but, if adequately trained, advanced nurse practitioners (ANPs) are well-placed to perform the procedure. Since 2014, ANPs working across the acute medical unit (AMU) and Ambulatory Emergency Care Unit (AEC) at Aintree University Hospital have been trained to perform lumbar punctures as part of their role.

Advanced nursing roles

In the Department of Health's (2000) *The NHS Plan*, the chief nursing officer highlighted 10 key roles for nurses that would allow them to use their knowledge, skills and expertise to develop proficiency and become advanced practitioners. In the last decade or so, the scope of nursing practice in hospital-based settings has been expanded widely through various initiatives. The Royal College of Nursing (RCN) has recognised these changes in practice, along with the fact that nurses now provide clinical interventions that were previously the domain of doctors (RCN, 2012).

The NHS workforce is made up of a range of professionals of whom just 10%

are doctors (Imison et al, 2016). This figure is forecast to decline and NHS Improvement (2016) has highlighted difficulties in recruiting doctors in general medicine. The shortage of generalists means there is a need to remodel the workforce – two ways of doing this are to foster new roles and advance those already in existence.

Diagnostic lumbar punctures

A lumbar puncture is a diagnostic procedure used to obtain a sample of cerebrospinal fluid (CSF) by inserting a hollow needle in the spinal canal. CSF is a clear, colourless fluid flowing in the subarachnoid space that protects the brain and spinal cord. It is constantly produced by the body, so the small amount removed during lumbar puncture is rapidly replaced. Changes in CSF can help diagnose neurological conditions such as a subarachnoid haemorrhage, meningitis, encephalitis and multiple sclerosis (Doherty and Forbes, 2014).

Lumbar punctures are often performed in AMUs, particularly for patients who present with sudden-onset severe headache (also known as 'thunderclap') but

Clinical Practice Innovation

whose computed tomography (CT) scans of the head do not show anything abnormal. A lumbar puncture is used to check for the presence of xanthochromia in the CSF.

Xanthochromia is a yellow discolouration that indicates the presence of bilirubin; bilirubin in the CSF can indicate a small bleed in the subarachnoid space. Small bleeds may not be detected by CT, as these scans do not have a 100% diagnostic sensitivity; if missed, however, small bleeds can have catastrophic consequences (Byyny et al, 2008). As such, correct lumbar puncture technique, specimen handling and interpretation of CSF results are critical (Bederson et al, 2009).

A skilled procedure

Lumbar puncture is a complex technical procedure that requires the ability to correctly identify spinal anatomy and insert the needle through the muscle layer and between facet joints into the subarachnoid space (Fig 1). It is known to be clinically difficult, with repeat attempts often needed by specialist services including radiology or anaesthetics (Williams et al, 2018). Patients who have to undergo multiple attempts can experience discomfort.

Doctors often learn practical procedures like lumbar punctures 'on the job', but this can mean patients receive suboptimal care and experience more complications than necessary (Defres et al, 2015). Beyond patient discomfort, other potential adverse effects of lumbar puncture are:

- Bleeding at needle insertion site;
- Post-procedural headache;
- Backache;
- Infection (rare);
- Nerve damage (very rare).

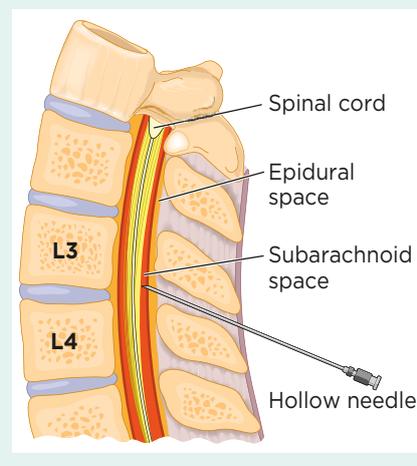
Lumbar punctures must be carried out by practitioners who have been trained in how to perform the procedure and are competent; if there is a lack of staff, the procedure will be delayed (Cooper, 2011).

Expected benefits

We wanted to be able to independently perform diagnostic lumbar punctures as part of our ANP role. The expected benefits included:

- Producing a core group of AMU staff skilled at performing lumbar punctures;
- Producing a core group of experienced ANPs available to train and support junior doctors learning how to perform lumbar punctures;
- Providing a standardised approach to training and education;

Fig 1. Lumbar puncture



- Reducing the risk of failed procedures and multiple attempts at obtaining CSF;
- Enhancing care by improving the patient experience;
- Reducing length of stay and improving patient flow.

Competency framework

We identified the need to develop a specific competency framework to ensure there is a robust pathway for ANPs to perform diagnostic lumbar puncture safely and independently. This competency framework:

- Would provide evidence that ANPs had undergone training and gained practice;
- Would serve as a framework for future staff members;
- Could be developed to include a wide range of other advanced clinical skills.

The idea was to use the competency framework both as a resource and a record of learning, thereby giving ANPs the chance to enter their learning record into a personal portfolio that could be used for revalidation.

The competency framework requires ANPs to demonstrate:

- Knowledge and understanding of the relevant anatomy of the lumbar spine and surface area;
- The ability to correctly identify the intervertebral space in the lumbar spine between L2/3, L3/4 and L4/5;
- Knowledge and understanding of the pharmacology of the local anaesthetic used in practice;
- The ability to explain the procedure to the patient in a way that they will understand;
- The ability to prepare the patient and equipment, and perform the procedure, in a safe and efficient manner;

- Knowledge and understanding of the potential complications.

To ensure ANPs have the appropriate knowledge and skills, they are assessed by a doctor who has both adequate experience and seniority.

Training and assessment

ANPs learn the lumbar puncture technique by attending the clinical skills medical training session for foundation doctors organised by the trust's medical education department. During that session, the procedure is demonstrated and trainees practise on a model, in a safe environment with no risk of harming patients.

Further practical experience is gained by observing at least five lumbar punctures performed at the AMU, following which ANPs can start practising under direct medical supervision. Each supervised lumbar puncture is recorded and assessed (Box 1). After ANPs have successfully performed at least five lumbar punctures under supervision, an AMU consultant or named medical trainer with competence in the procedure observes them performing a lumbar puncture and determines whether they have achieved competency.

ANPs need to study independently to acquire the necessary knowledge of anatomy and pharmacology; that knowledge is then verified in the form of an oral examination plus ongoing questions during supervised practice.

Once ANPs have successfully completed the practical training, theoretical training and supervised practice, the evidence is signed off in a competency assessment record and they are allowed to perform the procedure independently.

Outcomes so far

Three ANPs completed their training in August 2015, and a newly recruited ANP is in the process of being trained. A recent audit has showed a 40% increase in the number of lumbar punctures performed by ANPs at our AMU between March-May 2015 and March-May 2017. There was also a 12% reduction in the number of multiple attempts per patient; only one successful attempt at a lumbar puncture was made in 75% of patients in March-May 2017, compared with 63% in March-May 2015. This led to an average (mean) 12-hour reduction in length of stay.

The trained ANPs form an easily accessible source of training and supervision for junior doctors. This means patients are not waiting as long as before to undergo

the procedure and are less likely to experience multiple attempts at obtaining CSF.

Local formulary

Consideration was given to the prescription and administration, by ANPs, of local anaesthetics. All ANPs at the AMU are independent non-medical prescribers. It was agreed to add lidocaine 1% and 2% to the local ANP formulary. This was a slow process – taking at least three months – as the formulary had to be resubmitted to the trust's drugs and therapeutics committee. This delayed ANPs becoming fully independent to perform lumbar punctures. Having to get doctors to prescribe lidocaine while waiting for the formulary to be changed was also inconvenient.

Patient consent

A key aspect of performing a lumbar puncture is gaining the patient's informed consent. ANPs had to receive formal training to gain consent for lumbar puncture and went through a competency-based assessment by the ANP lead consultant. Records of competency are kept at trust level in the clinical governance department.

O'Toole (2003) defined informed consent as the ability of patients to understand the information given to them and make a decision based on that information. As no written patient information about lumbar puncture was available in our trust, we produced an explanatory leaflet to support patient decision making, thereby ensuring they are able to give true informed consent.

Documentation

While training to perform lumbar punctures, during practical observation and baseline audit in 2015, the ANPs found that documentation of the procedure was poor. The baseline audit looked at 26 lumbar punctures performed on 19 patients between March and May 2015. Dates and/or times were missing, records were often illegible and there were inconsistencies in what was documented. One record even omitted to say that the procedure had been performed. The documentation of informed consent was also inconsistent: the audit found that 73% of patients had inadequate consent documented.

To improve documentation, we looked at structured proformas in the medical literature, such as that created by Brodrick et al in 2014 (Bit.ly/ProformaLP) and then devised our own lumbar puncture checklist. Unfortunately, a second audit conducted in 2017 has shown that the checklist

Box 1. Areas assessed during supervised lumbar puncture

Each supervised lumbar puncture performed by an advance nurse practitioner is assessed and recorded on a form based on the Direct Observation of Procedural Skills form used for doctors' training. The form covers the following areas:

- Demonstrating understanding of indications, relevant anatomy and technique for the procedure
- Obtaining informed consent
- Demonstrating appropriate preparation pre-procedure
- Administering appropriate analgesia or safe sedation
- Technical ability
- Aseptic technique
- Help-seeking where appropriate
- Post-procedure management
- Communication skills
- Consideration of patient/professionalism
- Overall ability to perform the procedure

Adapted from the Direct Observation of Procedure Skills form used at Aintree University Hospital

is not regularly used and that it is generally doctors who do not use it. Potential reasons for this are the continual rotation of doctors in the acute medical area and a lack of awareness of the checklist's existence. We hope that this will change, as the checklist is now attached to the lumbar puncture CSF specimen pack issued by the pathology laboratory.

Ongoing audit

Audit will be ongoing to keep evaluating and improving practice, thereby improving the patient experience in the AMU and AEC. This should further reduce waiting times and lengths of stay. The ANPs keep a logbook of all the advanced procedures they have undertaken and supervised as evidence of continuing professional development. These logbooks may be used for future audit.

Current practice and next steps

We are two ANPs in the AMU and AEC who can currently carry out lumbar punctures and we have developed expertise in the procedure. We are often asked to perform lumbar puncture:

- On patients who are particularly anxious;
- If the procedure is likely to be difficult

- or has previously failed;
- On patients who need frequent therapeutic taps (to remove CSF and reduce intracranial pressure) for idiopathic intracranial hypertension.

We supervise and train junior doctors in the clinical environment and on the trust's medical clinical skills courses. To ensure our skills remain up to date, we are discussing the possibility of undertaking case-based discussions and/or intermittent observations of practice with medical supervisors.

Another ANP is being trained to perform lumbar puncture independently and the AMU also has two trainee ANPs who, following successful completion of their training, will also train to develop competency in performing the procedure. This will guarantee the presence of a pool of ANPs with expertise in lumbar puncture and who can support medical colleagues with their clinical skills training. **NT**

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