Abstract
The administration of medicines to patients with dysphagia presents substantial challenges to patient safety. Within stroke services, where up to half of patients may experience dysphagia, ensuring safe medication management is particularly challenging. This article describes how best practice within one stroke unit is being achieved by means of a knowledge-to-action service improvement project, ongoing education and training, and the input of a specialist dysphagia practitioner.

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DURING THE PAST decade, increasing attention has been given to the risks associated with the prescribing, dispensing and administering of medicines to patients with dysphagia. Initially, concerns focused on the specific legal and safety aspects of altering drug formulations to enable safer administration via feeding tubes, for example by tablet crushing or capsule opening (Wright 2002, Griffith and Davies 2003, James 2004), which led to the development of a clear protocol to guide clinical decision making (Wright et al 2006). It was established that healthcare professionals needed to consider alternative, liquid formulations of medicines, particularly for patients with enteral feeding tubes (Wright 2006). Consensus guidelines sought to achieve best practice in medication management for patients with dysphagia (British Association for Parenteral and Enteral Nutrition (BAPEN) 2004, Wright et al 2006). Detailed information and advice for nurses has been published (Kelly and Wright 2009), yet despite such guidance, dysphagia-related medication errors remain common, as reported previously in Nursing Standard (Wright and Kelly 2012).

The implications for practice of research findings on this important aspect of patient safety (Kelly et al 2009, Kelly et al 2011) are particularly relevant to acute stroke services, where between 37% and 78% of patients have dysphagia (Martino et al 2005). Indeed, in three of the four stroke wards observed by Kelly et al (2011), over half of patients experienced dysphagia; these figures are supported by observations undertaken during a stroke service improvement project at Sheffield Teaching Hospitals NHS Foundation Trust (Bennett et al 2011, Ilott et al 2011). Although research by Bennett et al (2011) and Ilott et al (2011) did not focus exclusively on medicine administration, some of the specific concerns regarding medication errors reported by Kelly et al (2011) and Wright and Kelly (2012) were also in evidence. These issues have since been addressed by raising staff awareness of dysphagia and introducing a targeted
programme of education and training. The purpose of this article is to describe how, through a multiprofessional, collaborative approach, safe administration of medicines to patients with dysphagia can be achieved within the context of stroke care.

**Identifying the issues**

Dysphagia encompasses a range of impairments that can affect any aspect of swallowing (Clarkson 2011), and is strongly associated with an increased risk of malnutrition and dehydration (Foley et al 2009, Rowat 2011), aspiration and pneumonia (Martino et al 2005). Clinical guidelines for the assessment and management of dysphagia after stroke are now well established (Intercollegiate Stroke Working Party 2012), but a research study undertaken within the Sheffield stroke service identified poor adherence to guidance for dysphagia management by both staff and patients (Pownall 2009). The issue was subsequently raised by the multiprofessional stroke team as a clinical risk issue. Gaps in knowledge and appropriate skills training were identified as major factors. Therefore, given that e-learning was increasingly being used in the trust as an approach to continuing professional development and mandatory training, the opportunity was identified to pilot an e-learning dysphagia management programme on the stroke unit.

This service improvement project (Bennett et al 2011, Ilott et al 2011) was facilitated through the Translating Knowledge to Action theme of the South Yorkshire Collaboration for Leadership in Applied Health Research and Care, which is funded by the National Institute for Health Research. A nursing lecturer (BB) was seconded as part-time project facilitator for 12 months from March 2010. The project aim was to develop, pilot, implement and evaluate strategies to promote evidence-based practice, in response to identified service priorities, by use of a ‘knowledge-to-action’ cycle (Gerrish 2010). The facilitator’s primary role was to support the staff with the e-learning programme and to evaluate its effectiveness in enhancing dysphagia management in general. In preparation for implementing the e-learning programme, observations of current nursing practice in dysphagia management were undertaken. Initially, observations were to focus specifically on mealtimes and the times when drinks were provided to patients; the primary function of swallowing was perceived as relating to nutrition rather than taking medicines (Kelly et al 2009). However, as a nurse, the facilitator suggested that to encompass all aspects of dysphagia management, observations should also include times when medicines were administered.

The pilot ward selected was a 28-bed subacute stroke rehabilitation unit at one of the hospital sites within the trust, where patients with dysphagia would be encountered routinely. Initially, two brief periods of general observation were undertaken by the facilitator, for the purpose of familiarisation with the ward and its routines. Following these initial observations, approximately 32 hours of focused observation took place over a two-week period, in eight sessions of four hours, between 7am and 11pm. A summary of observations, with areas for development and suggested actions, were reported to the ward manager and project team. However, unexpectedly, the observations were made during a period of time when a decision was made to relocate all stroke services to the other main hospital site, necessitating a repetition of the observations on a second stroke ward within the other hospital. Interestingly, although minor organisational differences in the delivery of patient care were apparent between the two sites, the reported observations of dysphagia management and issues raised were remarkably similar, including the administration of medicines to patients with dysphagia (Table 1).

**Positive practice**

Based on national consensus (BAPEN 2004), the trust’s guidance on the placement of fine bore nasogastric tubes and percutaneous endoscopic gastrostomy (PEG) tubes is available on the intranet to all staff and provides explicit instructions on the most appropriate methods of administering medicines and medicine formulations. This guidance also identified the role of the pharmacist in providing additional advice. In the stroke service, a consistent approach to ensuring that the most appropriate formulation was prescribed, dispensed and administered to patients was achieved through an established chain of verbal and written communication involving speech and language therapists (SLTs), nurses, doctors and pharmacists working within the stroke service.

Other successful practice development projects involving detailed and systematic enhancements to medication administration records have been reported (Jackson et al 2008, Santos et al 2012). However, within the stroke service examined in the present evaluation, methods of recording medicines to be administered had already proved to be effective. Instructions on patient medication...
charts clearly indicated whether tablets could be crushed or capsules opened, or whether a liquid formulation should be administered. In addition, the pharmacist had produced a list of commonly prescribed medications used in the stroke service, which provided more specific guidance for nursing staff to aid correct preparation of medicines (Table 2).

Tablet crushers were available at patients’ bedsides for individual use. Each patient requiring medication administration via a feeding tube had a measuring jug and oral syringes at the bedside for that purpose, as well as a bottle of sterile water for mixing with medicines and flushing the feeding tube. The measuring jugs and syringes were replaced every 24 hours. In summary, the nurses’ practice in the administration of medicines to patients with dysphagia was essentially safe, guided by clear written instructions and supplementary information. However, some inconsistencies in practice that did require attention were observed.

Areas for development

Administration of medicines via enteral feeding tubes

Occasions were observed when nurses discontinued nasogastric feeds and administered medicines without first flushing the feeding tube with water. Since some medicines are known to react with liquid feed, tube flushing is essential before medicine administration (White and Bradnam 2011); this aspect of safe practice clearly needed to be reinforced. On some observed occasions, several medicines were mixed together with water and administered simultaneously, contrary to recommended guidance (White and Bradnam 2011). Discussions with the pharmacist established that mixing medicines might not necessarily present a problem pharmacologically. In cases where interactions between medicines were known to be a risk, it would be indicated clearly on the prescription sheet that these medicines should be administered separately and at a different time. Nevertheless, the pharmacist advised that there was insufficient evidence to support any change to the trust’s guidance, which required all medicines to be administered individually and interspersed with a flush of 10mL water. The necessity of adhering to this guidance was subsequently addressed in the training programme. In addition, medicines can interact with enteral feed (for example phenytoin), and in this case White and Bradnam (2011) advise that the medicine is administered two hours after feeding has been suspended.

The preparation and administration of medicines to patients with dysphagia, particularly via enteral feeding tubes, is time-consuming. During the period of observation, it was usual practice for two qualified nurses to administer medicines to half of the patients on the ward each. However, at night, only one of the two qualified nurses on

### TABLE 1

<table>
<thead>
<tr>
<th>Issues for development</th>
<th>Action required</th>
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<tbody>
<tr>
<td>Feeding tubes are not always flushed with water before medicines are administered, although they are usually flushed with water afterwards. Contrary to recommendations that each medicine should be administered separately, with a water flush in between, medicines are sometimes mixed together with water and administered at the same time.</td>
<td>An educational update is required for nurses regarding safe practice in the administration of medicines via enteral and percutaneous endoscopic gastronomy tubes, in accordance with the trust’s guidance.</td>
</tr>
<tr>
<td>The process of preparing and administering medicines via enteral feeding tubes is already very time-consuming. Attention to the points above would inevitably add to the time required to complete the procedure safely.</td>
<td>Review current practice on how medicine rounds are conducted.</td>
</tr>
<tr>
<td>Although the crushing of sugar-coated dipyridamole has been authorised by the pharmacist, nurses report that the coating itself is difficult to crush completely and often results in a hard residue that can block the feeding tube.</td>
<td>Liaise with medical staff and the pharmacist about the formulation of medicines for administration via enteral feeding tubes.</td>
</tr>
<tr>
<td>Some patients who are moving on from enteral feeding to modified consistency diets still have their medicines administered via feeding tubes when they could possibly take them orally.</td>
<td>Liaise with the speech and language therapist.</td>
</tr>
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Although the crushing of sugar-coated dipyridamole has been authorised by the pharmacist, nurses report that the coating itself is difficult to crush completely and often results in a hard residue that can block the feeding tube. An educational update is required for nurses regarding safe practice in the administration of medicines via enteral and percutaneous endoscopic gastronomy tubes, in accordance with the trust’s guidance. In cases where interactions between medicines were known to be a risk, it would be indicated clearly on the prescription sheet that these medicines should be administered separately and at a different time. Nevertheless, the pharmacist advised that there was insufficient evidence to support any change to the trust’s guidance, which required all medicines to be administered individually and interspersed with a flush of 10mL water. The necessity of adhering to this guidance was subsequently addressed in the training programme. In addition, medicines can interact with enteral feed (for example phenytoin), and in this case White and Bradnam (2011) advise that the medicine is administered two hours after feeding has been suspended.

The preparation and administration of medicines to patients with dysphagia, particularly via enteral feeding tubes, is time-consuming. During the period of observation, it was usual practice for two qualified nurses to administer medicines to half of the patients on the ward each. However, at night, only one of the two qualified nurses on
duty would administer medicines and during one period of observation, it took between 9.15pm and 11.10pm to prepare and administer the medicines for 28 patients; approximately half of these patients had dysphagia, two had a nasogastric tube and five had a PEG tube. On this occasion, the other staff nurse on duty gave the medicines to one of the patients with a PEG tube to ensure timeliness of administration. The length of time required to administer medicines to patients with dysphagia and how this might affect patients receiving their medication at the correct time has been identified as a specific source of error (Kelly and Wright 2010, Kelly et al 2011, Wright and Kelly 2012), even though such a delay might not necessarily result in harm to the patient (Wright and Kelly 2012).

**Formulation of medicines**

Ideally, all medicines administered via enteral feeding tubes should be prescribed in a form that is suitable for this method of administration to avoid the potential risks to patient safety of altering solid dose preparations. Solutions or soluble tablets are the formulations of choice (White 2011). However, the limited availability of alternative formulations of medicines commonly used in stroke management created dilemmas for clinical decision-making, particularly as pharmacological interventions essential for secondary stroke prevention and the management of common, coexisting conditions such as diabetes and hypertension (Intercollegiate Stroke Working Party 2012) cannot be delayed or discontinued. For example, before the publication

<table>
<thead>
<tr>
<th>Drug</th>
<th>Formulation</th>
<th>Administration</th>
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<tbody>
<tr>
<td>Aspirin</td>
<td>Dispersible tablet</td>
<td>Tablets do not readily disperse in water. Tablets can be crushed, although this is difficult because of their coating, and then mixed with 10mL of water. The resulting suspension can be flushed down a feeding tube without causing a blockage. The manufacturer has no specific information regarding this route of administration, but the pharmacokinetics are likely to be altered if tablets are crushed. However, this is unlikely to cause any adverse effects.</td>
</tr>
<tr>
<td>Clopidogrel</td>
<td>Tablet</td>
<td>Disperses readily in water. Suitable for administration via an enteral feeding tube.</td>
</tr>
<tr>
<td>Simvastatin</td>
<td>Tablet</td>
<td>Tablets disperse in 10mL of water within five minutes to produce a coarse dispersion that breaks up when drawn into a syringe. The dispersion flushes easily down a feeding tube without causing a blockage.</td>
</tr>
<tr>
<td>Ramipril</td>
<td>Capsule</td>
<td>Capsules can be opened and the contents dissolved in water for administration via a feeding tube, directly into the mouth, or on a piece of bread. The contents are reported to have an unpleasant taste.</td>
</tr>
<tr>
<td>Thiamine</td>
<td>Tablet</td>
<td>Tablets disperse in 10mL of water within two minutes if shaken. The resulting fine dispersion can be flushed easily down a feeding tube without causing a blockage.</td>
</tr>
<tr>
<td>Lansoprazole</td>
<td>Capsule</td>
<td>Change to orodispersible tablets, which can be dispersed in 10mL of water. The granules settle quickly but can be administered via a feeding tube.</td>
</tr>
<tr>
<td>Metformin</td>
<td>Tablets (500mg, 850mg)</td>
<td>Available as powder sachets for reconstitution. Summary of product characteristics advises reconstitution with 150mL water. Sachets dissolve completely in 20mL of water to give a cloudy solution, with a pH of 4.5, which flushes easily down a feeding tube without causing a blockage.</td>
</tr>
<tr>
<td>Gliclazide</td>
<td>Tablets (80mg)</td>
<td>Tablets disperse in 10mL of water within five minutes to give a coarse dispersion. This flushes without causing a blockage but leaves a residue on the syringe and may leave residue inside the feeding tube; however, this residue is unlikely to be the active drug as gliclazide is soluble in water.</td>
</tr>
<tr>
<td>Amlodipine</td>
<td>Tablets (5mg, 10mg)</td>
<td>Tablets disperse in water within two minutes to produce a fine dispersion that settles quickly. The dispersion flushes easily down a feeding tube without causing blockage.</td>
</tr>
<tr>
<td></td>
<td>Tablets (2.5mg, 5 mg)</td>
<td>Tablets disperse in water (10mL) within two minutes to produce a fine dispersion that settles quickly. The dispersion flushes easily down a feeding tube without causing blockage.</td>
</tr>
<tr>
<td>Furosemide</td>
<td>Oral solution</td>
<td>Oral solution flushes easily down a feeding tube. Can be mixed with an equal volume of water if necessary. (For patients on restricted fluids, the medication will mix effectively with a small volume of fluid.)</td>
</tr>
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**TABLE 2**

Alternative formulations of medicines commonly prescribed in the stroke service
of the National Institute for Health and Clinical Excellence (NICE) technology appraisal on 
the prevention of occlusive vascular events 
(NICE 2010), the most common antiplatelet 
drug used in secondary stroke prevention in 
the local acute stroke service was modified-
release dipyridamole, in capsule form. Opening 
the hard gelatine capsule does not affect the 
properties of the drug as long as the granules 
inside remain intact (White and Bradnam 2011), 
but the action of opening the capsule is outside 
the terms of the drug’s product licence (Wright 
2011). A risk-benefit analysis is essential when 
making decisions about prescribing, dispensing 
and administering unlicensed medicines because 
the responsible healthcare professional becomes 
liable for any adverse effects experienced by the 
patient (Wright 2011). Mixing the modified-
release dipyridamole granules with water could 
still block a fine bore nasogastric tube (White 
and Bradnam 2011) but, crushing them was 
not an option because, in addition to the legal 
consequences, this could affect the drug’s 
pharmacokinetic profile and result in an excessive 
peak plasma concentration with toxic effects for 
the patient (White 2011).

A liquid formulation of dipyridamole is 
available but it is not licensed for use in secondary 
stroke prevention. In addition, because the 
liquid formulation is more expensive than 
the capsule form, and cost-effectiveness is an 
important consideration in prescribing practice 
(Sheffield Area Prescribing Committee 2010), 
the liquid formulation was not available within 
the trust. Therefore, as a manageable alternative 
to modified-release dipyridamole capsules and 
with pharmacist approval, standard sugar coated 
dipyridamole tablets (not modified-release) 
were administered, finely crushed before mixing 
with water. However, achieving a powder fine 
ought not to block a fine bore nasogastric tube 
was not easy, even with a tablet crusher. 
The replacement of dipyridamole with clopidogrel for 
mot patients (NICE 2010) has helped to resolve 
these prescribing and administration problems. 
In devising the list of alternative formulations 
for medicines commonly used on the stroke 
unit (Table 2), the pharmacist sought to avoid 
unlicensed preparations where possible, even in 
the case of recommending dispersible lansoprazole 
tablets, which was a more costly option than 
opening lansoprazole capsules.

**Administration of medicines to patients 
transitioning from enteral feeding to oral feeding**

Recovery of swallowing function is most likely to 
occur within the first three weeks after a stroke, 
and 95% of these patients with dysphagia will 
resume oral intake within three to nine weeks 
(Clarkson 2011). However, transitioning patients 
safely from enteral administration of medicines 
to oral administration can be problematic. 
A major factor may be that, although nurses rely 
on SLTs as the primary assessors and advisers in 
dysphagia management, SLTs receive little formal 
training in medication administration (Kelly 
and Wright 2009). The national descriptors 
for modified texture diets make no reference 
to swallowing medication (National Patient 
Safety Agency Dysphagia Expert Reference 
Group 2012) and SLTs are unlikely to undertake 
specific assessments of patients for swallowing 
medicines. Therefore, the advice SLTs can 
offer on this aspect of practice may be limited 
to suggestions of modifications to the 
formulation of medicines to promote safe 
swallowing, consistent with the appropriate 
texture diet they have recommended (Jackson 
et al 2008). The dysphagia instruction sheets 
used in the stroke service at Sheffield are 
displayed above patients’ beds and provide 
detailed guidance on appropriate food texture, 
fluid thickness, patient positioning, assistance 
or supervision required and indicators for 
discontinuing oral intake. However, no reference 
is made to oral medication.

The outcome of this situation was that 
oportunities were lost for nurses to identify 
whether patients could swallow medicines safely. 
Having been reassessed by the SLT as safe to 
proceed with small amounts of solid food modified 
to the appropriate texture, patients would undergo 
a ‘food trial’ for several days, during which 
nutrition and hydration were still provided via a 
nasogastric tube, but at mealtimes patients were 
assisted to take specified small quantities or food 
and/or fluids orally. However, this ‘trial’ did not 
appear to include medicines that could have been 
given orally (only when the feeding tube was 
removed were medications given orally).

**Resolving the issues**

The purpose of observing practice before 
providing an educational intervention was 
to identify if there were any inconsistencies 
in the management of dysphagia that could 
be addressed. The primary focus was on the 
management of nutrition and hydration, but the 
inclusion of medication administration enabled 
additional issues to be identified. Following 
consultation with the ward manager, stroke 
nurse consultant, SLT and pharmacist regarding 
areas for development, the project facilitator
included materials focusing on medication management in the dysphagia education and training programme.

Over the course of six months, the 22 nurses and ten healthcare assistants (HCAs) on the stroke ward where the observations had taken place were rostered in pairs to attend the training programme, details of which are reported elsewhere (Ilott et al 2011). A blended learning approach was used to combine e-learning programmes and practical skills to enhance awareness of dysphagia, enabling all staff to achieve the competency level of assistant dysphagia practitioner, as specified in the Inter-Professional Dysphagia Framework (Boaden et al 2006). For the HCAs, the swallowing component of the Stroke Training and Awareness Resources (STARs; www.strokecorecompetencies.org) core competencies module was used, plus a dysphagia module developed by the National Patient Safety Agency, which is available on the Skills for Health website (www.skillsforhealth.org.uk/e-learning). The qualified nurses also undertook the swallowing core competency, together with the STARs advancing module on feeding, hydration and nutrition. The practical skills component for both nurses and HCAs focused on thickening fluids to the correct consistencies.

An additional component focusing on medicines management in dysphagia was included for qualified nursing staff, with reference to the trust’s guidance. Discussion of current practice was encouraged to identify solutions to any challenges the nurses encountered in administering medicines to patients with dysphagia. At the end of the training sessions, all attendees were asked to identify one aspect of their practice in relation to dysphagia management that they wished to improve. Five of the qualified nurses specifically identified issues relating to medication management. Impact evaluation questionnaires, which were distributed individually to nurses approximately one month after the education intervention to evaluate its impact on their practice, revealed greater confidence in the nurses’ ability to manage dysphagia, including the administration of medicines (Ilott et al 2011).

This Translating Knowledge to Action project took place at a time of service reconfiguration, during which nursing staff were reallocated between the acute stroke wards and the rehabilitation unit, and new staff members were appointed. To enable staff to acquire the knowledge and skills required to deliver the service effectively, an in-service programme of education and training was provided, which included sessions focusing on medicines management and dysphagia that were jointly delivered by the project facilitator (BB) and the pharmacist (HB). The sessions focused on the safe administration of medicines via enteral feeding tubes, the importance to patient safety of adherence to the trust’s guidance, and the central role of the pharmacist in advising on appropriate formulations of medicines for administration to patients with dysphagia. However, at that time, the issue of how to support patients recovering from a stroke to swallow solid dose medicines had still to be resolved; this is now being addressed by a specialist dysphagia practitioner.

A product of the stroke service reconfiguration was the appointment of new ward managers, one of whom (CH) is also a specialist dysphagia practitioner (SDP). Within the context of the ward manager role, which also involves teaching, training and supporting other staff regarding the management of patients with swallowing difficulties (Boaden et al 2006), one of the ward managers (CH) identified the need for a protocol for the oral administration of medicines to patients with dysphagia, which she developed in collaboration with the stroke service pharmacist and SLT (Figure 1). The intention is to pilot the protocol on one of the stroke wards initially to identify where it should be displayed, for example, alongside the dysphagia management instruction sheets for individual patients. Familiarising the nurses with the protocol should also enable any specific education and training needs to be identified, which the SDP will address within the specialist practitioner role. Methods for evaluating the usefulness of the protocol are currently being designed.

### Ongoing developments

The time-consuming nature of administering medicines safely and correctly to patients with dysphagia remains challenging but the necessity to adhere to safe practice guidelines is paramount. Allocating the maximum available number of qualified staff to participate in the administration of medicines to the required times appears to be the logical solution, although competing clinical demands cannot always ensure that this is achieved. A potential solution could be to delegate some medication administration responsibilities to HCAs (Dickens et al 2008), which is consistent with Nursing and Midwifery Council (NMC) (2007) standards for medicines management. However, following brief discussion between the pharmacist and senior staff on the acute stroke unit, this...
Another possible approach to reducing the length of time taken in the administration of medicines could be to promote patient self-medication more actively, particularly for patients who are being prepared to be discharged. This approach is consistent with the recommendations of the National Service Framework for Older People (Department of Health 2001) and the National Clinical Guideline for Stroke (Intercollegiate Stroke Working Party 2012). Although a trust protocol on self-administration of medicines is readily available on the intranet, educating patients to manage their own medicines in preparation for discharge is not routine practice on the stroke wards at present. However, interest has been expressed in exploring how this could be implemented as an issue for ongoing development.

**Conclusion**

Kelly *et al* (2011) have argued that safe medication management for patients with dysphagia requires skilled and knowledgeable nurses and, therefore, continuing professional development opportunities are essential. This article presented a summary of how, by means of a knowledge translation project,
an educational intervention intended to focus on eating and drinking after stroke was adapted to encompass the administration of medicines. Observations identified positive practice but also identified areas where practice could be improved. In-service education has reinforced the principles of safe practice and the SDP is now taking a lead role in ensuring that best practice in medicines management for patients with dysphagia is achieved.

Acknowledgment

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