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Survey to explore understanding of the principles of aseptic technique: qualitative content analysis with descriptive analysis of confidence and training

Key words: Aseptic technique, infection prevention and control, content analysis, nursing

Abstract

Background: In many countries aseptic procedures are undertaken by nurses in the general ward setting but variation in practice has been reported and there is evidence that the principles underpinning aseptic technique are not well comprehended.

Methods: Survey employing a brief, purpose-designed, self-reported questionnaire

Findings: Response rate was 72%. Of these 65% nurses described aseptic technique in terms of the procedure used to undertake it and 46% understood the principles of asepsis. The related concepts of cleanliness and sterilisation were frequently confused. Additionally 72% reported that they not had received training for at least five years, 92% were confident of their ability to undertake aseptic technique and 90% reported that they had not been re-assessed since initial training. Qualitative analysis confirmed a lack of clarity about the meaning of aseptic technique.

Discussion: Nurses' understanding of aseptic technique and the concepts of sterility and cleanliness is inadequate in line with previous studies, potentially placing patients at risk.

Conclusion: Nurses' understanding of the principles of asepsis could be improved. Further studies should establish the generalisability of the study findings. Possible improvements include renewed emphasis during initial nurse education, greater opportunity for updating knowledge and skills post-qualification and audit of practice.

Words in abstract = 198

Background

The purpose of aseptic technique is to minimize the risk of introducing pathogenic organisms into wounds or other susceptible sites while preventing transfer of pathogens from such sites to other patients and staff (1). These underpinning principles were established in the nineteenth century (2) and their effectiveness in complex care bundles during the insertion and maintenance of intravascular lines and pulmonary-assisted-ventilation have been established in randomized controlled trials. In these studies doctors and nurses receive special training and procedures take place in operating rooms or dedicated treatment rooms under strictly controlled conditions (3, 4, 5). In many countries wound dressings, urinary catheterization and the insertion and removal of intravenous lines are undertaken by nurses under less stringently controlled conditions, often in the general ward setting, however. Despite its importance for patient safety this topic has attracted relatively little research. The few studies undertaken are small scale and poorly controlled (6, 7). They report considerable variation in the way that aseptic technique is practised in ward settings. We explored nurses' understanding of aseptic technique in two large inpatient facilities in Wales, United Kingdom (UK). The study was based on the premise that to practice safely, clinicians need to understand the aims of the procedure they are undertaking and what is necessary to achieve it. There is a clear gap in the recent literature about nurses' understanding of aseptic technique as practiced in the ward setting.

Methods

The aims of the study were to determine nurses' understanding of what is meant by the term 'aseptic technique', confidence undertaking it, opportunities to update knowledge and skills and undergo periodic re-assessment to maintain competency. This survey was undertaken with nurses because in the UK they are the professional group mainly responsible for undertaking wound dressings, urinary catheterization and removing intravenous lines for inpatients.

We targeted a random ten per cent sample of qualified clinical nurses employed on acute surgical and medical wards in each organisation responsible for undertaking procedures requiring aseptic technique as a regular part of their work (n=250). The sample included ward managers because they are expected to operate as role models and set clinical standards for ward-based procedures that involve asepsis. Unqualified nurses were excluded because in the UK they do not receive training to undertake aseptic procedures. One of the hospitals is part of a group that serves an urban and rural population of 600,000 people in south Wales. It provides a full range of acute, intermediate, primary

and community care services and employs 10,000 staff directly involved in patient care. The other hospital is part of a group providing care to a population of 133,000 in mainly rural localities across mid-Wales. It employs 6,500 staff directly involved in patient care.

Data were collected with a short questionnaire. Informants were asked "Please state your understanding of the meaning of the terms 'aseptic technique' in your own words". Closed questions established informants' clinical grade, area of practice, information about training in aseptic technique and experience and confidence in ability to practise. Questionnaires were distributed by a team of data collectors not acquainted with the informants throughout the two organisations during a one week period in July 2016. They were returned in person in envelopes to the data collectors immediately on completion.

Analysis

Data from the open question were subjected to summative content analysis in a two-step procedure according to the method described by Hsieh and Shannon (8). In the initial step (manifest content analysis) use of key words required to understand asepsis (e.g. 'clean', 'sterile', 'disinfect') and phrases relating to the meaning of the term 'aseptic technique' were documented and taken at face-value. We inspected the data for the frequency that each key term was used alone and in conjunction with the others. In the second stage (latent content analysis) we explored the underlying meaning of these key words and phrases. Detailed, repeated inspection and discussion of the text took place between members of the research team to look for evidence that nurses' definitions of aseptic technique demonstrated understanding of the underlying principles. Using summative latent content analysis we explored how often nurses used particular terms such as 'cleaning' or 'sterility', confusion over the use of these terms and apparent gaps in understanding. Two members of the research team worked on each response independently then in pairs to discuss and interpret findings. Any disagreements were resolved through third party arbitration. Informants' definitions of aseptic technique were validated against the standard definition above (1).

Data from the closed questions were categorised according to the questions on the fixed-choice scale, keyed into an SPSS computer file (version 24) and analysed descriptively (means, medians, bar charts).

Ethical considerations

Permission to undertake the study was granted by the Research Ethics Committee in the University where the principal investigator was employed. The questionnaires were anonymous and were returned in envelopes; informants were assured that they and their employing organisations would not be identified in publications. Informants received a one page information sheet about the study and signed consent forms. Infection prevention has received considerable attention from policy-makers and managers in recent years and in some cases punitive methods have been employed in attempts to improve compliance (9, 10). We obtained data in a ward setting rather than in classrooms, and were mindful that health workers have reported resentment and frustration with constant reminders about infection prevention (11). The brief, anonymous questionnaire was designed to avoid anxiety and encourage participation.

Findings

Questionnaires were completed by 180 qualified nurses (72% response rate). Most were in clinical posts in junior (n=125, 68.1%) or middle levels of seniority (n=32, 17.6%). Twenty six (14.3%) were ward managers. There was no significant difference in response between hospitals.

Manifest content analysis

One hundred and forty three (78%) qualified nurses responded to the open question and of these one claimed not to understand what aseptic technique meant. Manifest content analysis revealed that over half (n=91, 64.9%) identified aseptic technique in terms of a procedure or method, not the principles underpinning it. Typical examples are reproduced below:

'Cleaning your wound trolley before and after dressings. Opening all your dressings/packs prior to putting your gloves on to do your dressing. Using hand gel. Putting your gloves on and washing hands/drying.' Informant 15

'Cleaning the trolley before you place a pack on it. Washing your hands. Getting someone to drop sterile gloves on the sterile field inside the pack. To put gloves on without touching the outsides. Then someone to put all objects needed for the procedure onto the sterile surface without touching it.' Informant 49

Other nurses restricted their responses to selected elements of the procedure, singling out hand hygiene, avoiding touching equipment and use of gloves for special mention. Wound dressings were usually suggested as an example of a

procedure requiring aseptic technique. The insertion and management of intravenous lines and urinary catheters were occasionally mentioned.

Fifteen (10.5%) nurses used the words 'non-touch aseptic technique' and a further fifty eight (41%) used the term 'sterile' in relation to the equipment or the field/environment in which the procedure was conducted:

'A procedure that uses a sterile technique.' Informant 33

'Performing a task by having a sterile workplace … and only using sterile equipment.' Informant 29

'Using a sterile field in procedures.' Informant 36

The terms 'clean' or 'cleanliness' were used by 19 (14.4%):

'Reduce infection. Clean procedure.' Informant 52

Five nurses mentioned the need to apply 'strict rules' to achieve asepsis without elaborating on what such rules might entail. Three nurses commented that the procedure should be standardised.

Latent content analysis

Close inspection of the text identified differences in the completeness and accuracy of the information offered. Many responses (n=57, 41%) were extremely brief:

e.g. 'no-touch technique'.

Less than half (n=65, 46%) explained the principles underlying aseptic technique. It was variously described as being necessary to 'minimize infection', 'prevent risk of infection', 'eliminate infection', 'ensure absence of infection', 'prevent spread of infection', 'avoid cross-infection', 'prevent contamination', 'protect the patient', and 'protect staff and patients' each mentioned by one or two individuals only. Other responses reflected confusion in relation to the terms 'sterility' and 'cleanliness' which were often used inter-changeably within the same response:

'Carrying out a procedure under clean, sterile conditions to protect the patient from infection.' Informant 20

Although a fifth of the sample alluded to the need to avoid contamination, this was often suggested in relation to the equipment rather than to the vulnerable site on the patient and failed to acknowledge that other patients and staff should be protected.

Only six informants displayed precise understanding of the core principles of asepsis, albeit briefly expressed:

'Performing a procedure without contaminating the wound … any cross-contamination. Non-touch technique.' Informant 118

'Don't touch the site of the procedure or the materials you're going to use to execute it.' Informant 35

Informants appeared to be unaware that the contents of the dressing pack should no longer be considered sterile once it had been opened. A typical example is given below:

'Doing a procedure that remains sterile to minimise the risk of infection.' Informant 46

Responses to the closed questions

Most respondents (n= 164, 90%) reported that they had received training in aseptic technique but for the majority it had been re-assessed at least five years previously (n=130, 72%). Only 55 (30%) reported that they had been re-assessed since initial nurse training. Thirty eight (21%) had attempted to update knowledge in their own time by looking at practice guidelines (n=15, 8%); *e*-learning (n=19, 10%) or accessing miscellaneous resources (n=11, 6%). These included articles in professional nursing magazines and an online manual of nursing procedures that is available to National Health Service staff in the UK. Some nurses had accessed more than one resource. Most nurses reported feeling very confident (n= 60, 33%) or confident (n= 108, 59.3%) about undertaking aseptic technique. However they also agreed that it is very important (n= 73, 40.1%) or important to receive updates (n=96, 52.7%), that re-assessment of practice is very important (n=52, 28.6%) or important (n=98, 53.8%) and that it

is very important (n=78, 42.9%) or important (n=83, 45.6%) to standardise aseptic technique.

Inferential statistical testing did not detect any relationship between the employing organisation, clinical grade, training to undertake aseptic technique or confidence with the accuracy and completeness of knowledge.

Discussion

This study indicates that nurses' understanding of aseptic technique possibly lacks accuracy and completeness and may place patients and staff at risk of cross-infection. It corroborates the findings of earlier, much smaller studies (6, 7). Our study is more comprehensive than earlier research. These studies did not explore comprehension of the concepts of sterility and cleanliness which are central to understanding and conducting aseptic technique and did not document opportunities for updating knowledge and clinical skills. We established that understanding of sterility and cleanliness is confused and that although opportunities for updating and assessment are not widely available and would be welcome, nurses are over-confident of their ability to practise competently, placing patients and themselves at risk.

Aseptic procedures are intricate. They can require considerable manual dexterity in addition to an understanding of what the procedure is supposed to achieve and which sites and equipment should be handled to avoid contamination and risks of cross-infection. The often complex decision-making processes involved require the ability to apply general principles to specific situations. Our study has demonstrated for the first time that these principles may not be widely or sufficiently understood. This might may stem from lack of reinforcement of knowledge and skills after initial training, which for many of the nurses in this sample had not taken place for a considerable length of time. The extent that post-qualification updating is available in other countries has not been explored. The quality of initial training might also be a contributory factor. Aseptic technique appears to be taught in relation to specific clinical procedures during nurse training in many countries, not as an overarching separate principle with wide application (12, 13). During clinical placements students are exposed to variations in practice that do not always accord with classroom teaching (14, 15, 16) further hampering acquisition of the appropriate knowledge and skills. In the UK where our study was undertaken, competency undertaking aseptic technique is no longer routinely assessed during nurse training and the content of nursing

curricula varies between teaching centres. Little time is allocated to teaching the fundamentals of medical microbiology and infection prevention (17) and a recent study suggests that nurse educators' understanding of the topic is suboptimal (18). This gap in fundamental nursing education is a cause for concern as it will result in qualified nurses being unable to transfer aseptic technique knowledge and skills between settings, placing patients at risk and increasing the likelihood of cross-infection and inability to respond safely to innovations in practice. Equipment and the environment differ between acute hospitals where most nurses obtain initial experience and home and primary care where many later practice, especially in the UK where there is an increasing trend to deliver care in non-acute settings. Innovations in aseptic procedures abound (19, 20, 21) but they do not obviate the need to understand the core principles. In particular, aseptic non-touch-technique (21) which is being heavily promoted in the UK and other countries (22) was developed primarily for use during the insertion and management of intravenous lines. It demands a nuanced understanding of asepsis, especially when applied to wound dressing changes which seem to be the aseptic procedures most frequently undertaken by nurses. Being trained to perform a procedure by rote instead of understanding its underpinning principles will compromise patient safety irrespective of what the steps of the procedure entail.

Nurses' tendency to explain aseptic technique as the steps of a clinical procedure might also reflect the teaching style adopted during initial training and available study materials. Recipe-style descriptions of the procedure are apparent in nursing textbooks and professional magazines (23, 24) of the type accessed by the relatively few nurses in our sample who attempted self-instruction. Authors of these articles provide detailed descriptions of the steps of aseptic technique, usually in relation to changing wound dressings, and dwell on the lack of evidence to support minutiae (such as whether dressing trolley surfaces need to be washed or disinfected and whether items on the sterile field should be manipulated with gloved hands or forceps) while ignoring the principles of Listerian antisepsis that are well established (2). Failure to emphasise the principles underlying asepsis in these resources is likely to contribute on confusion and hinder safe practice.

Although most clinicians practise aseptic procedures on a daily basis competency is not regularly updated and assessed as it is for other infection prevention precautions, notably hand hygiene. Nurses are the professional group most widely studied because of their accessibility: they are the single largest

professional group and have close, regular patient contact (25, 26). Hand hygiene has received emphasis because it is widely regarded as the most important infection prevention precaution (27) and despite concerns over the methodological challenges associated with data collection, audit is nevertheless considered relatively straightforward and inexpensive (28). Hand hygiene updates are mandatory in many countries and in some organisations poor compliance can result in disciplinary action (9, 10). Aseptic technique has received far less attention, probably because it takes place in treatment rooms or behind bedside curtains and is less accessible, more complex and takes longer to document. The findings of our study suggest that aseptic technique would benefit from receiving similar attention to hand hygiene. The way that it is taught during nurse education and opportunity for continuing professional development need to be explored and improved as necessary.

Study limitations

The internal validity of the study could have been undermined by the informal approach taken to data collection. Informants might have felt rushed or failed to take the exercise seriously enough to provide written explanations of aseptic technique in as much detail as they might if the data had been collected under classroom conditions, under-estimating comprehension. Inviting a sub-sample of informants to discuss their responses to ensure correct interpretation is recommended to improve the credibility of studies involving content analysis (8) but was not possible because the questionnaires were anonymous to encourage participation. However, the advantages of the informal approach we adopted are likely to have outweighed disadvantages as informants had no opportunity to check information or collude with one another, thus ensuring that the views expressed were their own. Data collection under classroom conditions would probably have compromised response rate given the negative feelings expressed towards the unrelenting emphasis placed on infection prevention in recent years (9, 10, 11).

The approach taken to recruitment might have compromised transferability. This is mitigated however as nurses in different clinical grades and wards were equally distributed within the sample and the two organisations did not differ in terms of patient population or workforce to many others in the UK.

We did not attempt to watch aseptic technique as direct observation of infection prevention is likely to alter practice (28). It is therefore impossible to determine whether the deficits in knowledge identified in this study affected the way that aseptic technique was undertaken.

CONCLUSIONS

Nurses' understanding of the principles of asepsis could be improved. Further studies should establish the generalisability of our findings. Possible improvements include renewed emphasis during initial nurse education, greater opportunity for updating knowledge and skills post-qualification and audit of practice.

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Conflicts of interest

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Competing interests statement

There are no Competing interests to declare