Challenges and controversy on the NIVAS podium

Inaugural Annual Conference, 12 & 13 May 2010, London
Introduction

It is hard to beat the National Infusion and Vascular Access Society (NIVAS) for drive, determination and sheer chutzpah. Just 10 months after its foundation, it hosted a 2-day inaugural conference, featuring an impressive, multidisciplinary faculty of speakers, a busy exhibition area and an agenda that ranged from scientific presentations through to hands-on practical skills workshops.

On the opening morning, when Lisa Dougherty took the stage at London’s elegant Hotel Russell, she reminded the delegates that 12 May was an auspicious date—the birthday of Florence Nightingale—and she believed that the founder of modern nursing would have been proud to see a meeting involving so many nurses with specialist skills and experience. But she went on to emphasise that NIVAS is not only for nurses. “We are a multiprofessional society, and we want you to encourage your medical and pharmacy colleagues to join,” she said.

Intravenous therapy and biofilm

The conference took on an international as well as a multidisciplinary perspective with the first speaker—Cynthia Crosby, a clinical microbiologist originally from the USA and Vice President of Global Medical Affairs, Infection Prevention, at CareFusion. She delivered an overview of the risk of hospital-acquired infection, from both a scientific and a practical viewpoint, and emphasised the need for clear processes, teamwork and empowerment of nurses to intervene when infection control rules are breached.

She began by highlighting a striking difference in intravenous care provision between the USA and the UK. In her home country, nurses do not generally place central venous catheters (CVCs) (except in trauma). “You are leading nursing in a new direction,” she said. But she also reminded delegates of the hazards of intravenous care, citing government data showing that 42% of hospital-acquired bloodstream infections in the UK in 2006 were related to CVCs. A show of hands indicated that several individuals in the audience had seen patients die as a result of such infections. The financial burden is also heavy. A study as long ago as 1999 estimated that hospital-acquired bacteraemia cost the NHS about £1 billion per year—and the figure is likely to be much higher now.

National surveillance in the UK has identified staphylococci as the cause of more than 40% of hospital-acquired infections. “And that is because it’s the number one organism on our skin,” said Cynthia. “Skin—the patient’s and the healthcare worker’s—is the primary source of the infecting organisms.”

While CVCs are a key vehicle for hospital-acquired infections, peripheral venous catheters are associated with almost 2% of cases, and the risk is greatest when these lines are placed in A&E.

The good news, said Cynthia, is that multidisciplinary alliances are working hard towards control of contamination, with an increased emphasis on hand hygiene, washing of catheter hubs and, in the UK, diligent recording of infections with methicillin-resistant *Staphylococcus aureus* (MRSA). She strongly recommended the use of infection-control checklists by all healthcare personnel—including medical staff. “It is very empowering for nurses, who should make sure they stop procedures if the checklist is not followed properly.”

In the second half of her presentation, Cynthia discussed the phenomenon of medical biofilm—the aggregation of micro-organisms (notably staphylococci) encased in polysaccharide “slime” that develops on catheters and other indwelling medical devices. Biofilm is difficult to penetrate with antibiotics and is a source of infection. However, it is possible to reduce its development through scrupulous hygiene, for example disinfection of all devices before use, and careful compliance with the instructions issued by manufacturers. When long-term intravenous access is required, Cynthia
also recommends consideration of antimicrobial locks, and she presented a wealth of data on their efficacy.

The likelihood of development of antibiotic resistance with the use of antimicrobial skin washes and locks was a key theme in the lively question-and-answer session that followed this presentation. Cynthia suggested that use of antiseptics rather than antibiotics would reduce the risk of resistance developing. She also advocated firm control of antibiotic use, with a requirement for a pharmacist to authorise any request for agents not listed in the hospital formulary.

Intravenous antibiotics—use and abuse

The discussions following Cynthia's talk provided the ideal introduction to the next presentation—an examination of “the good, the bad and the ugly” of antibiotic use. Esmita Charani, Research Pharmacist at the Centre for Infection Prevention and Management, Imperial College London, was keen to emphasise the value of antibiotic treatment, including intravenous delivery, but she also highlighted the importance of antibiotic stewardship, which she defined thus:

- A marriage of infection control and antibiotic management
- Compliance with mandatory infection control
- Selection of antibiotics that do the least collateral damage
  - To the patient
  - To other people
- Appropriate de-escalation of treatment when culture results are available (e.g. switch from broad-spectrum to selective antibiotic)

She pointed out that whereas hospital doctors do not usually prescribe outside of their own speciality, most will prescribe antibiotics for a patient with an infection. Around a third of hospital patients at any one time are receiving antibiotics—and unnecessarily so in up to 50% of cases. “Inappropriate and excessive use of antibiotics leads to drug resistance, increased mortality and morbidity, increased cost, increased litigation and reduced quality of life,” Esmita told the conference. She also reiterated the message that intravenous treatment creates a portal for infection, and agreed with the previous speaker that the extent of the human and financial burden of hospital-acquired infection is still underestimated.

She charted the inexorable rise of drug resistance across the world, and pointed out that the development of new antibiotics is not keeping pace, largely because these drugs tend not to be seen as highly profitable by pharmaceutical companies. However, there are political drivers in place, notably the UK Antimicrobial Resistance Strategy and Action Plan and Antimicrobial Prescribing, part of the Saving Lives toolkit produced by the Department of Health. Nurses, she said, could play a crucial role as patients’ advocates by helping to bring about behaviour change, and perhaps through inclusion in antibiotic stewardship.

A questioner from the audience asked whether hospitals now need to establish antimicrobial teams, to be in charge of all antimicrobial prescribing in every department. Esmita agreed with the sentiment, but feared that the culture of clinical autonomy would inhibit such a development. She asked the nurses present if they felt they could have an impact on local antibiotic use. One delegate pointed out that nurses are a heterogeneous group, and would not all have the necessary expertise. She added that any initiative intended to control antibiotic use should aim to include appropriately skilled individuals from various healthcare disciplines.
Central venous catheter (CVC) insertion in north-west London

Tim Wigmore, Consultant in Intensive Care Medicine at the Royal Marsden Foundation Trust, London, told the conference that he was “overwhelmed” to see so many specialists in intravenous therapy in one place.

His presentation, on the development of a CVC care bundle for use in north-west London, began with a brief review of the risk of complications of CVC insertion, in particular infection, and the need to reduce risks through good practice. He defined a care bundle as “a group of interventions related to patients with intravascular central catheters that, when implemented together, result in better outcomes than when implemented individually”. For CVC insertion, the five main elements of a care bundle have been defined in the USA as:

- Hand hygiene
- Maximal barrier precautions
- Chlorhexidine skin antisepsis
- Appropriate catheter site and administration system
- Regular review of continued requirement

Tim cited “remarkable resistance” to measures such as thorough handwashing and use of gowns, masks and caps, despite “irrefutable evidence” for their efficacy in infection control. He also presented evidence for the superiority of chlorhexidine to iodine for skin antisepsis and for the reduced risk of infection with antibiotic-coated versus standard CVCs.

Choice of catheter site is less straightforward. Compared with subclavian lines, femoral lines have higher rates of mechanical, infective and thrombotic complications. However, the skill of the operator plays a key role—subclavian insertion can have serious complications if not done well. His advice is to avoid femoral insertion where possible.

After presenting trial evidence for the benefits of incorporating all of the above five elements into a care bundle, Tim went on to explain why he had added a sixth—ultrasound guidance of insertion. He outlined the complications of the alternative approach—the landmark technique—and pointed out that ultrasound guidance is the option preferred by the National Institute for Health and Clinical Excellence (NICE). “It doesn’t matter who you are, there is no excuse for not using ultrasound,” he told the conference. “And that means you are unlikely to be able to put CVCs in on the wards.”

As for implementation of a CVC bundle, Tim maintained that the elements should be combined physically as well as procedurally: “It helps compliance enormously if everything is kept together—not just the cannulae etc, but also the gown, mask, cap and patient drape.”

And the results? Tim reported a large drop in infection rates since the care bundle was introduced—including a cautiously noted zero infection rate in the intensive care unit.

A question from the audience focused on nurse training in CVC insertion, and Tim proposed the need for a national programme. “Perhaps NIVAS will be the forum for this,” he said.

Another delegate questioned the feasibility of ending the practice of CVC insertion on wards, arguing that ready access to a specialist area would be difficult in a busy district general hospital. Tim cited his known team’s audit findings, showing that there is always opportunity for line insertion in the anaesthetics room. “And the environment there is so much safer than on the ward.”
Expert witness (the records usually speak for themselves)

In contrast to the previous scientific/clinical programme, NIVAS board member Katie Scales provided a fascinating insight into the role of the healthcare professional as an expert witness, based on her own experience.

After defining the differences between an expert advisor (who helps determine, before legal action, whether a claimant’s case has substance) and an expert witness (who assists the judge, impartially, to reach an understanding of the issues), Katie presented a case that she has been involved with.

A young woman sustained a hypoxic head injury following an air embolism related to her intravenous care. The focus of the claim fell on the nurse who had handled the intravenous infusion. However, analysis of the care records demonstrated significant lapses in care, which resulted in severe clinical dehydration. The dehydration was demonstrated by a review of nursing and medical documentation, including the medical notes, observation charts, fluid charts, weight charts, drug charts and blood results. The venous access device involved in the incident had been thrown away and could not be tested for equipment error.

The opinion that Katie delivered as an expert witness was: “…the actual event of air embolism was an unfortunate clinical accident, the cause of which is unknown. However, had the patient not been dehydrated prior to the incident the event may not have occurred or may have been less severe. Fluid balance monitoring by nursing staff and review of that information by medical staff may have prevented the air embolism.”

As Katie summed up for the conference: “In the end, the records spoke for themselves.”

Decision making processes during intravenous (IV) drug administration

Lisa Dougherty returned to the podium—this time as a presenter—and outlined a qualitative ethnographic study she has conducted showing that nurses sometimes fail to follow safe practice when preparing and administering intravenous drugs, even though they are aware of how to practise safely.

Failure to check patients’ identity was one of the factors detected. During observation, just 13 out of 20 nurses checked some aspect of the patient’s identity and/or allergy status before intravenous drug administration, and only seven checked completely in accordance with hospital policy. At interview, nurses explained that they would not always formally check the identity of someone they knew well. However, Lisa maintained that such checks were essential, no matter how long the nurse had known the individual involved. In response to a question from the audience, she said nurses assumed (probably wrongly) that patients would feel affronted if a nurse they knew well checked their identity every time.

There was greater compliance with the requirement to check the administration details of the drugs being given, despite the nurses’ familiarity with the agents involved.

Lisa also recorded a high rate of interruptions and distractions—on one ward there were 502 entries and exits to and from the clinical room during the times observed, with morning being the busiest period. At interview, the nurses did not regard such interruptions as distracting unless they were personally asked a question. However, when interrupted, they did not follow procedure, which requires them to go back through the checking process.

A nurse focus group suggested that errors could be related to the timing of drug administration. In practice, Lisa observed several anomalies related to timing:
- Patients were sometimes not available (e.g. at a meal or undergoing tests) at the time the dose was due.
- Nurses tended to start preparing the dose at the time it was due to be delivered, rather than at an appropriate time beforehand.
- There was a culture of giving evening drugs early to avoid disturbing patients' sleep.

None of the nurses that Lisa observed thought that such errors of timing could have an effect on patient outcomes.

The findings of the study (anonymised) have been fed back to the wards as an aid to nurse education.

### Ensuring competency in calculation of doses and rates of administration

Lisa’s nurse education theme was continued in the next presentation, by Keith Weeks, Reader of Health Professional Education at the University of Glamorgan, and Research and Design Director, Authentic World Ltd. Emphasising the need to ensure an individual’s competency before allowing them to enter clinical practice, he presented a model whereby competency is assessed in a virtual environment.

He explained that competence in the calculation of medication dosage involved the overlap of three more narrowly defined areas of competence:

- **Conceptual competence**
  - Correct interpretation of the dosage calculation problem
  - Accurate set up of the dose and rate equations
- **Calculation competence**
  - Correct calculation of the values for the dose and rate of administration
- **Technical measurement competence**
  - Selection of appropriate measurement vehicles
  - Accurate measurement of the dose at rate of administration

After presenting a short video demonstrating the reconstitution of a powdered medication and the drawing off of the resulting solution into a syringe, Keith explained how the details of the procedure could be broken down into individual components (e.g. patient's age/weight, correct storage of medication, handwashing) using expert system analysis and used to design an algorithm. Having examined expert practice, the next step is to carry out an error analysis, identifying potential errors at every stage (e.g. failure to note the patient's age/weight, inappropriate storage of medication, failure to wash hands).

These detailed algorithms can be used to create a virtual—but authentic and real-time—model for practitioner training and assessment, as Keith demonstrated in a short presentation of an e-learning exercise on dose calculation. It is difficult to do justice to the model in words, but it can be accessed on the NIVAS website (www.NIVAS.org.uk) Assessment using the model has shown a high level of congruence with clinical practice—practitioners tend to make the same sorts of errors in both settings.

Keith said: “High-fidelity virtual clinical environments offer opportunities to redefine competence within cognitive, physical and social contexts. These environments are creating a paradigm shift in facilitating the learning of essential knowledge and skills, the diagnostic assessment of errors and the systematic crafting of competence. They are much closer to real practice than a word-based assessment can ever be.”
**Standardisation of intravenous infusion concentrations**

This two-part presentation kicked off with Peter Keeling, Consultant Anaesthetist at Frimley Park Hospital NHS Trust, Surrey, who explained why standardisation of the concentrations of intravenous medications would benefit patient safety. He charted the many steps involved in preparing and administering an intravenous drug solution and the resulting high probability of error arising at some stage—73% risk of at least one error, according to research. Furthermore, nearly 9% of prescriptions contain errors, and there is a 31% risk of error during reconstitution. Movement of staff between units following different reconstitution practices adds to the potential for mistakes being made.

Peter listed several advantages of standardisation of drug concentration, from a medical, pharmacy and nursing perspective:

- **Medical advantages**
  - Would allow pre-preparation by industry
  - Dose/rate charts could be created to simplify prescribing and administration
  - Electronic prescribing could be implemented more effectively
  - Emergency drugs could be predawn in a sealed disposable unit
  - Easier transfer of patients between units
  - Use of standard infusion and driver
  - Easier/safer rotation of doctors and nurses between units

- **Pharmacy advantages**
  - Development of licensed products at realistic prices
  - Easier stock control
  - Better implementation of NPSA Alert 20

- **Nursing advantages**
  - Reduced time spent on infusion preparation
  - Reduced likelihood of errors in e.g. calculation, reconstitution, infusion rate, labelling
  - Less need for retraining when staff move between units
  - Potential to put training into the undergraduate curriculum
  - Overcomes innumeracy problems

Mark Borthwick, Consultant Pharmacist at Oxford Radcliffe Hospitals NHS Trust, then considered how standardisation could be achieved.

His team’s survey has shown that despite a high degree of variability in the concentrations of 20 intravenous medications in use in critical care units across the UK, there are some clear areas of agreement, for example in the concentration used for noradrenaline and adrenaline. A second survey asked units whether certain standard solutions at specified concentrations would be acceptable, if they became commercially available. Respondents were also asked to give reasons for rejecting the proposed standard solution. There was a high level of acceptance of most of the concentrations offered, and no rational reasons for refusal were given (non-rational reasons included tradition and consultant preference).

The next steps in this ambitious exercise include agreeing product specifications and engaging the interests and commitment of major pharmaceutical companies, followed by publicity via an article in a high-impact journal emphasising the patient safety advantages of this approach to intravenous medication. Mark also plans to repeat the survey with another list of drugs.

Commenting from the audience, Katie Scales was clearly enthusiastic about the potential for improved patient safety and for “phenomenal time saving”. She urged the team to make sure the planned publication was available in a journal with general readership. “And if you get these standardised products onto the shelves of intensive care units, the rest of the hospital will want them too,” she predicted.
Any port in a storm: pros and cons of central venous access (CVA) ports

The advantages and disadvantages of CVA ports versus Hickman lines and peripherally inserted central catheters (PICCs) were presented by Matthew Gibson, Consultant Interventional Radiologist at the Royal Berkshire Hospital. In favour of ports, he cited ease of use, a lower risk of infection and reduced need for maintenance, in addition to patient factors such as comfort, cosmetic acceptability and compatibility with bathing/swimming and caring for small children (who might grab an external line). On the negative side, he listed the relative complexity of insertion and removal and the risk of erosion, flipping and disconnection. Also, CVA ports are unsuitable for some patients, for example those who are very thin.

CVA port insertion is carried out under ultrasound guidance and, at the Royal Berkshire, was initially Matthew’s responsibility until first one then a second clinical nurse specialist underwent the necessary training. The delegates were shown a short video demonstrating the insertion technique.

Patient choice is often a key issue when deciding whether or not to insert a port, although Matthew expressed concern about a “middle class bias”, whereby the technique is offered to those who have researched CVA on the internet. “Perhaps we need better protocols to determine who is fitted with a port,” he suggested.

For services that have not yet started using ports, he recommended careful preparation before introducing the service. “Then just get out there and do it,” he said. The rewards would include a useful extension to the CVA service and new knowledge and skills for staff, as well as the clinical benefits.

During the ensuing discussion, an audience member said that she would always advocate a CVA port for an eligible patient rather than a Hickman line or PICC. However, she was frustrated by the unwillingness of some inpatient services to use a pre-inserted port. Matthew agreed, but predicted that other healthcare professionals would gradually become more familiar with the use of ports.

Needles or plasters for children? How parents decide

The implanted port versus external catheter debate was continued by an examination of how the choice is made for paediatric patients. NIVAS board member Karen Bravery, Nurse Practitioner at Great Ormond Street Hospital for Children, London, told the conference that, in the absence of a national protocol on which type of CVA is best, parents are offered a choice.

Karen has completed a study of parents’ experience of making the decision on behalf of their children (all under 5 years of age and receiving treatment for acute lymphoblastic leukaemia), and the factors that affect their choice. The study (an interpretive phenomenological analysis) was based on semi-structured interviews conducted on the ward when parents and their children were attending for a follow-up appointment.

Results from six families were analysed. Four families opted for an implanted port, which was seen as allowing children to take baths and go swimming and engage in rough-and-tumble play; fear of needles (on the part of the child or parent) was a key reason for choosing an external catheter. Four families described the decision as difficult and stressful, particularly since it came soon after their child’s diagnosis, whereas two families found the decision straightforward and said they had received all the information they needed. All of the families valued the support and information they received from the specialist nurse, but they would welcome more practical details, such as photographs of the devices in situ, case studies and video interviews with families who have already made the decision. Some of the parents would like more explicit advice from their healthcare professionals—and perhaps the option of having the decision made for them.
The next phase for Karen’s research will include consideration of a patient decision tool, designed to help parents arrive at an informed choice.

What happens with the tip is not in the superior vena cava (SVC)?
Liz Simcock, Clinical Nurse Specialist—Central Venous Access at UCL Hospitals NHS Trust, London, presented some of the challenges and controversies in the positioning of the venous access tip. Appropriate positioning is essential to avoid complications such as thrombosis (when the tip is outside the SVC) and cardiac risks (when the tip is below the junction of the SVC and the right atrium). Liz also expressed preference for CVA over midlines in patients receiving chemotherapy, on the grounds of the risk of thrombosis in this population.

The difficulties associated with accurate tip positioning include interpretation of the patient X-ray image (e.g. the tip is not always visible, or the borders of the SVC can be difficult to define), definition of the boundaries of acceptable positioning and atypical anatomy (e.g. right-sided heart). Liz illustrated the challenges in practice by showing several radiographic images of unusual anatomy and of tips that had not been properly placed—many of which had been inserted at the patient’s bedside rather than the radiology suite—and tips that had moved post-placement.

A commentator from the audience courted a degree of controversy when he agreed wholeheartedly with Liz’s aversion to midlines. “They are dreadful—don’t use them,” he said. And he praised Liz for a presentation that demonstrated the complexity of a procedure often regarded as easy.

Midlines in the community
Having heard such negative views of midlines, it was interesting to hear Beverley Cattermole’s argument for their use in the community. “They play an important role in facilitating patients returning home while on intravenous therapy,” said Beverly, Infusion Therapy Specialist Nurse in the High-tech Care Team at Berkshire East Community Health Services. Use of a midline can also help to avoid the cost of unscheduled cannulation.

She explained that midline is classified as a peripheral device, is placed around the antecubital fossa area or upper arm, and the tip does not extend beyond the axillary vein (i.e. it is shorter than a PICC). X-ray guidance is not required, because the line is not in the central system, and positioning can be achieved using ultrasound or the landmark technique. She stressed the importance of clear labelling of midlines, to make sure they are not used inappropriately—they are unsuitable for vesicant therapies or those with an osmolarity greater than 500 mOsm/l.

The settings in which Beverley has placed a midline include community wards, the local hospice, the community psychiatric hospital, residential and nursing homes and patients’ own homes. When placing a midline for a patient at home, she said that the practitioner “needs to be resourceful”. An assistant is required—either a colleague or, in some cases, a family member. And she advocates the use of a large sterile field to provide plenty of working room.

Beverley went on to present several scenarios in which access to a midline has enhanced patient care, for example through avoiding readmittance to acute care.

As with any intervention, there are some potential pitfalls. Beverley and her colleagues have encountered leakage from the exit site of some midlines. If phlebitis develops, it usually settles down—but in rare cases it requires removal of the midline. Also, it is not possible to see the effect on the local vein. Current guidelines from the Royal College of Nursing do not recommend using midlines for obtaining blood samples, but Beverley and her colleagues have done so successfully. There is a
lack of evidence on the length of time that a midline can be left in place, but one manufacturer has had the licence for its midline extended beyond 30 days.

Although Beverley identified cost savings as one of the potential benefits of community-based use of midlines, a member of the audience said that a funding anomaly had prevented local implementation of a similar service. The primary care trust argued that, under NHS tariffs, it would not have to pay extra for an extended hospital stay, but would have to pay for community care after discharge. Beverley agreed that such funding issues were frustrating, but pointed out that her community-based service helped to fulfil the government’s commitment to increased care delivery close to patients’ homes.

Skills workshops

For the final sessions of the day, delegates were invited to attend any two of the following tabletop workshops:

- Port accessing
- Cannulation
- PICC dressing and securement
- Unblocking CVA devices
- How to use cleaning solutions

The workshops provided an opportunity to see and handle devices that delegates might be unfamiliar with, and to gain advice on good practice. The sessions also generated some lively discussion and exchange of ideas and views. Even the most experienced intravenous access practitioners commented on how much they had learnt.

Conference close

As Lisa drew the 2-day proceedings to a close, she reflected on the evident success of the conference, and thanked everyone who had been involved in its organisation, including the main sponsors—CareFusion and Baxter Healthcare—and all the manufacturers that had taken part in the exhibition. She also had a big thank you for the delegates: “Without you, there would have been no conference.”

Make sure you do not miss the next NIVAS Annual Conference, which will be held at the Hotel Russell, London, 15–16 June shortly. Registration details will be available on the NIVAS website shortly (www.NIVAS.org.uk/conference).