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DEVELOPMENT AND VALIDATION OF A VEIN ASSESSMENT TOOL (VAT)

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ABSTRACT

Objective: To assess the face validity and the inter-rater reliability of the Vein Assessment Tool (VAT) for classifying veins according to their level of intravenous insertion difficulty.

Design: Prospective observational study.

Participants: Eight nurses and two radiographers from the Medical Imaging Department and five nurses from the Haematology Day Patient Unit of a large tertiary hospital.

Intervention: Assessments of veins in the upper limb were undertaken independently by nurses from two departments of a major tertiary hospital.

Main outcome measure: Level of inter-rater agreement assessed using intraclass correlation coefficients (ICC).

Results: A total of 125 independent assessments were made by 15 nurses. The mean percentage agreement between raters from Medical Imaging was 84% (SD 10.7; range 60% to 100%) and between raters from Oncology was 92% (SD 17.9; range 60% to 100%). The inter-rater reliability was very high for the ten medical imaging raters 0.83 (95% confidence interval CI = 0.61 - 0.95) and for the Oncology raters 0.93 (95% CI = 0.77–0.99).

Conclusion: The Vein Assessment Tool (VAT) has been validated by a sample of nurses with cannulating experience. Following broader testing it may be useful for research studies or by nurses who wish to objectively describe the condition of a vein for clinical purposes.

INTRODUCTION

Peripheral venous cannulas are commonly used in hospitalised patients for the administration of fluids, blood products, drugs and nutrition. It has been estimated that approximately 150 million peripheral intravenous catheters are placed each year in North America.(Schmid 2000); similar data for Australia is unavailable. Nurses are increasingly responsible for placing and re-siting cannulas, particularly in specialty areas such as medical imaging, emergency departments, intensive care units and oncology day therapy units. Although guidelines for placing peripheral cannulas exist, their focus is on site selection, device selection and infection control precautions (Intravenous Nurses Society 1998); scant attention has been paid to vein quality.

VEIN QUALITY ASSESSMENT

The ability to objectively define vein quality became important when designing a study to identify risk factors associated with contrast media, or X-ray dye, extravasation. Clear and distinctive categories were required but descriptions of how veins are selected or rated by nurses are often vague. For example 'healthy veins have the ability to distend with tourniquet pressure' (McDiarmid et al 1999) or, veins are selected by 'vision, palpation or a combination of both' (LaRue 2000). For the study a more precise measure was needed. Consequently an electronic literature search for specific vein quality assessment tools was conducted, which yielded two instruments. The first of these studies was in two parts. Part one of the assessment involved grading the vein using a 10cm visual assessment scale from 'as easy as it could possibly be to 'as difficult as it could possibly be'. In part 2, the assessor completed a 12 item check list about factors relating to IV insertion difficulty, for example rolling

vein and tough skin (Jacobson 1999). After reviewing the instrument, it was considered to be too complex for use in the planned extravasation study.

Vein assessment in the second study involved a five level scale: 'veins neither visible nor palpable; veins visible but not palpable; veins barely visible and palpable; veins visible and palpable, and veins clearly visible and easily palpable' (Lenhardt et al 2002). No inter-rater reliability testing was reported for the scale and staff in the Medical Imaging Unit considered in practice that it could be difficult to differentiate between the five classifications. This led to the development of an assessment tool that met the needs of the study. Hence the aim of this sub-study was to assess the face validity and inter-rater agreement of the Vein Assessment Tool (VAT).

METHOD

Participants.

Patients

Inpatients, outpatients and members of the public were recruited from the waiting area of the Medical Imaging Department and from the Haematology Day Patient Unit of a large, tertiary care, public hospital. They were told about the purpose of the study and asked if they would agree to nurses making an assessment of the veins in their limbs. Verbal consent was accepted. There were no exclusion criteria. Demographic data was not considered relevant for the study, so none was collected. Nor was institutional ethics review required as volunteers were not being exposed to any intervention which was not a part of their routine care.

Raters

Fifteen raters participated in this study: eight nurses and two radiographers from the Department of Medical Imaging; and five nurses from the Oncology Day Therapy

Unit. All of the raters were expert phlebotomists with many years of cannulation experience.

Instrument

The intention was to keep the instrument as simple and practical as possible. Definitions of vein quality were developed by the authors in consultation with other nurses on the unit. Following this, a group of expert cannulation nurses examined the items for face validity and minor adjustments were made to the instrument. Figure 1 shows definitions for each level of vein quality and the level of experience required to cannulate veins at each level.

Figure 1: Vein classification according to the Vein Assessment Tool (VAT)

Vein Assessment Tool (VAT)		
Vein quality	**Definition**	**Management**
Good	Vein is easily visible and/or easy to palpate when tourniquet is applied	Cannula may be inserted by any health care practitioner accredited to do so
Fair	Veins are small, scarred or difficult to palpate	Cannula to be inserted by an expert in venous cannulation
Poor	Vein unable to be seen or palpated (requires heat pack to aid vasodilation)	Cannula to be inserted by an expert in venous cannulation

PROCEDURE

Eight nurses and two radiographers from the Department of Medical Imaging (assessors) agreed to grade the quality of veins of ten volunteers using definitions on the Vein Assessment Tool (VAT) as a guide. Each volunteer was assessed by 10 assessors. Assessment of vein quality was restricted to upper limbs but not to a

specific site. With the volunteer in a sitting position, a tourniquet was placed around the arm above the elbow of the arm in which veins were to be assessed. Each assessor made their assessment independently without any opportunity to discuss their assessment with other participants. The method was repeated in the Oncology Day Therapy Unit with five oncology nurses as the assessors and 5 oncology outpatients as volunteers (each volunteer was assessed by 5 nurses). Thus a total of 125 observations were made.

ANALYSIS

Inter-rater agreement was assessed in two ways. First by percentage agreement between raters; and secondly, by comparing the VAT ratings made by the nurses and radiographers on the 15 patients using Intraclass Correlation Coefficients (ICC's) with confidence intervals of 95% (95% CI). The ICC measures how much of the total variance of scores can be attributed to differences between subjects (Bravo and Potvin 1991) and is used when replicate measures have no time sequence; in this study when more than one assessment was made on the same vein (Pereira-Maxwell 1998). Poor correlation and systemic score differences result in reduced values. ICC values range from 0 to 1; values of 0.7 and over are considered to indicate 'substantial agreement' and values of 0.5 to 0.7 are considered to indicate 'moderate agreement' (Schene et al 2000). A sample of 15 patients is sufficient for a reliability study with 10 raters with an estimated ICC correlation of 0.9 (Bonett 2002). Statistical analyses were performed using SPSS for Windows® release 13.0.1 (SPSS Inc).

RESULTS

The mean percentage agreement between raters from Medical Imaging was 84% (SD

10.7; range 60% to 100%) and between raters from Oncology was 92% (SD 17.9; range 60% to 100%). The inter-rater reliability was very high for the ten medical imaging raters 0.83 (95% confidence interval CI = 0.61 - 0.95), and even higher for the Oncology raters 0.93 (95% CI = 0.77–0.99).

DISCUSSION

The aim of this study was to develop and validate a simple instrument for use as a guide for vein assessment. Results indicate that the Vein Assessment Tool is appropriate and suitable for this purpose. The validity of the instrument was supported by the mean percentage agreement between nurses using the scale and high intraclass correlation coefficients, indicating a high level of agreement between the nurses who independently assessed the quality of patient's veins.

Although other measures of vein assessment have been used for study purposes (Jacobson 1999; Lenhardt 2002) to our knowledge, this is the first, published attempt to validate such an instrument. The VAT is also simple to use. There are only three categories and they are clear and unambiguous. By comparison, the methods described by Jacobson (1999) for describing vein quality are complex and time consuming and those used by Lenhardt et al (2002) are unclear and capable of misclassification.

The VAT has now been in use for over six months in the Department of Medical Imaging for the assessment of patients recruited into the extravasation study. Many nurses and radiographers have been involved in the assessments and when asked, they find the instrument easy to use. Specifically, there have been no reports of any difficulty in classifying patients' veins in one or other category, suggesting that the tool could be useful for other research purposes.

The VAT also indicates the type of competency required to insert a cannula at each level making the instrument ideal for standardising care and for teaching new staff. It could be used in any area of clinical practice where the documentation of vein assessment is required. For example, many hospitals support or utilise a specialist intravenous (IV) service to access difficult to cannulate veins. Use of an objective instrument, such as the Vein Assessment Tool, could guide decisions about when to call in such a specialist. This in turn may reduce the incidence of failed IV cannulation, which is as high as 28% in some series (Lenhardt 2002), causing considerable distress for patients.

LIMITATIONS

The tool has been tested on only two groups of nurse clinicians who regularly insert peripheral intravenous lines. It is likely that these nurses are more skilled than generalist nurses in identifying and classifying vein quality (Palefski and Stoddard 2001). The study would have been strengthened if nurses who were not as familiar with vein assessment had been included. It would also have been useful to correlate the vein assessment rating with the actual level of difficulty with vein cannulation in order to assess the sensitivity and specificity of the instrument.

CONCLUSION

The Vein Assessment Tool (VAT) has been validated by a sample of nurses with cannulating experience. Following broader testing it may be useful for research studies or by nurses who wish to objectively describe the condition of a vein for clinical purposes.

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