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Clinical trial

Randomised clinical trial of elective re-siting of intravenous cannulae

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***Introduction*: Peripheral venous thrombophlebitis (PVT) represents a considerable source of iatrogenic morbidity, occurring in about 20% of hospital in-patients. The aim of this prospective randomised study was to investigate the effect of elective change of intravenous cannulae on the incidence of PVT in hospital in-patients.**

***Patients and Methods*: General medical and surgical inpatients requiring intravenous therapy were randomised into control (n = 26) or study (n = 21) groups. Cannulae in the control group were only removed if the site became painful, the cannula dislodged, or there were signs of PVT. Cannulae in the study group were changed electively every 48 h. All patients were examined daily for signs of PVT.**

***Results*: Peripheral venous thrombophlebitis developed in 11/26 patients in the control group and 1/21 patients in the study group (P = 0.003). Elective change of cannulae did not significantly increase the total number of cannulae sited (41 cannulae in the control group versus 43 in the study group).**

***Conclusions*: Elective change of cannulae resulted in a significant reduction in the incidence of infusion phlebitis. The authors recommend that elective re-siting of intravenous cannulae becomes standard practice for all patients requiring intravenous therapy.**

Key words: Intravenous infusions – Thrombophlebitis – Crystalloid

Over 50% of hospitalised patients require an intravenous cannula, of which up to 20% will develop peripheral venous thrombophlebitis (PVT).[1,2] The clinical consequences of PVT range from mild erythema to frank suppuration and systemic sepsis. PVT is, therefore, a source of considerable iatrogenic morbidity, and should not be considered a 'minor' complication.

In patients receiving peripheral parenteral nutrition, it has been shown that elective change of intravenous cannulae results in a marked reduction in the incidence of PVT.[3] The aim of this study was to investigate the effect of elective change of short Teflon® cannulae every 48 h on the incidence of PVT in general medical and surgical in-patients receiving intravenous crystalloids and drugs.

Patients and Methods

Patients

Forty-seven patients were included in this randomised, controlled, un-blinded study. Ethical approval was obtained from the Scarborough Local Research and Ethics

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Table 1 Patient characteristics

	Control Group	Study Group	*P**
Number of patients	26	21	
Elective admission	13	10	0.871
Age (years)	60.5 (15.5)	62.7 (18.2)	0.674
Male:female	15:11	14:7	0.529
Cannula gauge	18.4 (3.25)	18.7 (1.72)	0.622
Total days cannulated	3.84 (2.03)	3.81 (1.6)	0.955
No. cannulae per patient	1.64 (0.76)	1.95 (0.67)	0.144

Continuous variables are presented as mean (SD).
*Student's *t*-test for continuous variable, Chi-square for categorical variables.

Table 2 Infusates administered

	Control group (n = 26)	Study group (n = 21)
Crystalloid alone	10	5
Drugs alone	4	5
Crystalloid + drugs	12	11

Table 3 Episodes of peripheral venous thrombophlebitis

	Control group	Study group
Incidence of phlebitis	11/26	1/21*
Severe	2	0
Moderate	5	0
Mild	4	1

*P = 0.003 compared to control group (Chi-square).

Committee. Patients requiring intravenous therapy admitted to a general medical or surgical ward were seen by the principal investigator, and after giving informed consent were randomised by sealed envelope into either control (n = 26) or study (n = 21) groups. Patients were excluded if they were under the age of 18 years, already had a cannula *in situ*, or were due to receive peripheral parenteral nutrition. Patients in the two groups were well matched for age, sex, and acute versus elective admissions (Table 1).

Table 2 details the infusates received by patients in the study. There were no significant differences in the types of infusate received between control and study groups. Three patients in the control group and 5 in the study group received intravenous steroids, and 2 patients in the study group received a blood transfusion.

Study protocol

Routine practice in the authors' institution was for clinical support workers or junior doctors to perform the task of i.v. cannulation. These individuals performed all of the cannulations in the study, at the instruction of the principal investigator. Short Teflon® peripheral cannulae (Venflon® 2, Ohmeda, Sweden) were inserted using strict aseptic technique and secured using a sterile transparent dressing (IV 3000, Smith and Nephew Healthcare). Cannulae in the control group were only removed if the site became painful, the cannula dislodged, or there were signs of PVT. Cannulae in the study group were changed electively every 48 h. The study protocol stipulated that when a cannula was changed electively the original cannula should remain *in situ* until a new cannula was inserted. Only 2 attempts were made and if these proved unsuccessful the fact was recorded.

All patients were reviewed daily by the principal investigator, and examined for signs of PVT at the current and all previous infusion sites. Peripheral venous thrombophlebitis was defined as the development at an infusion site of two or more of the following signs: pain, erythema, swelling, excessive warmth, or a palpable venous cord.[4] Phlebitis was recorded as mild (erythema less than 2 cm), moderate (erythema greater than 2 cm) or severe (erythema greater than 2 cm with pain).

Statistical analysis

Data were stored on a Microsoft Excel spreadsheet and statistical analyses performed using XLStatistics (Rodney Carr 1997–2002). All continuous variables are presented as mean (SD). Differences between groups were compared using Student's *t*-test or Chi-square test as appropriate.

Results

A total of 43 cannulae were sited in the control group, and 41 in the study group (Table 1). The mean gauge of cannula was similar in both groups – 18.4 G (SD 3.25) in the control group (median 20 G) and 18.7 G (SD 1.72) in the study group (median 19 G; P = 0.622, Student's *t*-test). The mean length of time from insertion of the first cannula until removal of the last cannula was 3.84 days (SD 2.03 days) in the control group and 3.81 days (SD 1.6 days) in the study group (P = 0.955; Student's *t*-test).

Episodes of peripheral venous thrombophlebitis are described in Table 3. PVT developed in 11 patients in the control group, and only 1 patient in the study group (P = 0.003; Chi-square). The patient who developed PVT in the study group was one of two patients in whom a cannula had inadvertently been left *in situ* for more than 48 h (breach of protocol). In those patients who developed phlebitis, the mean length of time from insertion of a cannula to development of phlebitis was 2.5 days (SD 1.3 days; range, 1–5 days).

Discussion

In this prospective study, elective re-siting of intravenous cannulae every 48 h resulted in a significant reduction in the incidence of infusion phlebitis in hospital in-patients patients receiving intravenous crystalloid and drug therapy.

This study was designed as a prospective randomised controlled trial. The randomisation process was designed to minimise the effect of confounding factors and the biases which can occur in simple observational studies. The composition of the study population (Table 1) was representative of a mixed group of hospital inpatients; the intravenous fluids and drugs administered (Table 2) were those in common usage. Short Teflon® (polytetrafluoroethylene, PTFE) cannulae were used as these were readily available and PTFE has been shown to be more haemocompatible than materials such as polyurethane or polyvinyl chloride.[5]

The authors recognise that neither study participants nor investigators were 'blinded'. This was logistically difficult due to the nature of intravenous cannulation. However, it must be stressed that cannulae in both groups were inserted by the same individuals, and that a strict protocol was adhered to in assessing phlebitis. Even a small area of erythema was recorded as 'mild' phlebitis (Table 3).

There is no doubt that the infusion of fluid into a vein predisposes to PVT. Factors relating to the infusate which have been shown to influence the development of PVT include osmolality, pH, chemical composition and rate of infusion.[6,7] However, it has also been demonstrated that the presence of an intravenous cannula without an infusion running results in PVT, with an incidence of about 40% over 5 days.[8] This provides the rational for minimising endothelial trauma, by electively removing cannulae before phlebitis has time to develop.

In this study, elective change of cannula at 48 h significantly reduced the incidence of PVT. It is interesting to note that the mean time to develop phlebitis in the control group was 2.5 days. These data would suggest that endothelial trauma caused by an in-dwelling cannula is recoverable if this is removed within 48 h following insertion, but that PVT is likely to develop if a cannula is left *in situ* for longer than this.

Elective change of cannulae did not increase the total number of cannulae placed (41 cannulae in the 26 control subjects versus 43 cannulae in the 21 study subjects). This was largely due to the number of re-cannulations which had to be performed in the control group as a result of the development of PVT. These data negate the argument that elective cannula change is detrimental due to patient discomfort associated with 'unnecessary' cannula insertion.

Conclusions

Elective change of cannulae in the current study resulted in a significant reduction in the incidence of infusion phlebitis, and did not lead to an increase in the number of cannulations performed. The authors recommend that elective re-siting of intravenous cannulae becomes standard practice for all patients requiring intravenous therapy.

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