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Devices and dressings to secure peripheral venous catheters: A Cochrane systematic review and meta-analysis☆

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ABSTRACT

Background: Peripheral venous catheterisation is the most frequent invasive procedure performed in hospitalised patients; yet over 30% of peripheral venous catheters fail before treatment ends.
Objectives: To assess the effects of peripheral venous catheter dressings and securement devices on the incidence of peripheral venous catheter failure.
Data sources: We searched the Cochrane Wounds Group Register, The Cochrane Central Register of Controlled Trials, MEDLINE; EMBASE and CINAHL for any randomised controlled trials comparing different dressings or securement devices used to stabilise peripheral venous catheters. The reference lists of included studies were also searched for any previously unidentified studies.
Results: We included six randomised controlled trials (1539 participants) that compared various dressings and securement devices (transparent dressings versus gauze; bordered transparent dressings versus a securement device; bordered transparent dressings versus tape; and transparent dressing versus sticking plaster). Trial sizes ranged from 50 to 703 participants. The quality of evidence ranged from low to very low. Catheter dislodgements or accidental removals were lower with transparent dressings compared with gauze (two studies, 278 participants, risk ratio (RR) 0.40; 95% confidence interval (CI) 0.17–0.92, P = 0.03%). However, the relative effects of transparent dressings and gauze on phlebitis (RR 0.89; 95% CI 0.47–1.68) and infiltration (RR 0.80; 95% CI 0.48–1.33) are unclear. A single study identified less frequent dislodgement or accidental catheter removal with bordered transparent dressings compared to a securement device (RR 0.14, 95% CI 0.03–0.63) but more phlebitis with bordered dressings (RR 8.11, 95% CI 1.03–64.02). A comparison of a bordered transparent dressing and tape found more peripheral venous catheter failure with the bordered dressing (RR 1.84, 95% CI 1.08–3.11) but the relative effect on dislodgement was unclear.
Conclusions: There is no strong evidence to suggest that any one dressing or securement product for preventing peripheral venous catheter failure is more effective than any other product. All of the included trials were small, had high or unclear risk of bias for one or more of the quality elements we assessed, and wide confidence intervals, indicating that further randomised controlled trials are necessary. There is a need for suitably powered, high quality trials to evaluate the newer, high use products and novel – but expensive – securement methods, such as surgical grade glue.

What is already known about the topic?

- A peripheral venous catheter is typically used for short-term delivery of intravascular fluids and medications, however they often fail before treatment is complete.
- Failure can occur due to inadequate securement of the device to the skin, resulting in the catheter falling out or complications such as phlebitis (irritation or inflammation to the vein wall), infiltration (fluid leaking into surrounding tissues) or occlusion (blockage).

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- Inadequate securement may also increase the risk of a catheter-related bloodstream infection, as the peripheral venous catheter moving in and out of the vein allows migration of organisms along the catheter and into the bloodstream.
- Peripheral venous catheter dressings play a vital role in preventing catheter complications. However, despite the many dressings and securement devices available, the impact of different securement techniques for increasing peripheral venous catheter dwell time is still unclear.

What this paper adds

- There is no strong evidence to suggest that any dressing or securement product for peripheral venous catheters is more effective than any other.
- We found limited evidence that catheters were less likely to fail due to dislodgement or accidental removal when a transparent dressing was used, compared with gauze.
- Implications for the need of high quality research have been identified.

1. Background

Peripheral venous catheters are flexible, hollow, plastic tubes that are inserted in a peripheral vein, most commonly the metacarpal vein of the hand, or alternatively the cephalic or basilica vein of the lower forearm (Dougherty, 2008; Tagalakis et al., 2002). They are typically used for the short-term delivery of intravascular fluids and medications. Peripheral venous catheters are an essential element of modern medicine and their insertion is the most frequent invasive procedure performed in hospitals, with up to 80% of all hospitalised patients requiring one (Zingg and Pittet, 2009). In the United States of America, an estimated 330 million peripheral venous catheters are sold each year (Hadaway, 2012). However, catheters often fail before intravenous treatment is completed, which usually requires catheter replacement. Reported failure rates, or unscheduled restarts, range from 33% to 69% (Harwood et al., 1992; Rickard et al., 2010; Royer, 2003; Smith, 2006; Bolton, 2010). Peripheral venous catheters fail for a wide range of reasons; the most commonly identified causes of failure are partial dislodgement or accidental removal, phlebitis (irritation or inflammation to the vein wall), occlusion (blockage), infiltration (fluid moving into surrounding tissue), leakage and, rarely, infection (Rickard et al., 2010; Bolton, 2010; Webster et al., 2008).

Effective catheter stabilisation may reduce the incidence of catheter failure and prevent problems associated with re-siting. For example, a peripheral venous catheter must be inserted through the patient's skin, which normally acts as a protective barrier against bacteria entering the blood stream. Breaking the barrier may lead to phlebitis (Tagalakis et al., 2002; Monreal et al., 1999) or, more rarely catheter related blood stream infection (Maki et al., 2006). Repeated access attempts may also cause future venous access difficulties, including the need for a central venous catheter. In addition, waiting for a catheter to be re-sited can result in an interruption to the delivery of intravenous therapy and medicines with a potential increase in the duration of hospital stay and healthcare costs (Tagalakis et al., 2002; Monreal et al., 1999; Dillon et al., 2008).

Despite a plethora of dressings and devices marketed for securing peripheral venous catheters, only one other systematic review has addressed the effectiveness of these products in preventing catheter related complications. The authors found that there was an increased risk of catheter tip infection when transparent dressings were used compared with gauze but no differences were found in the incidence of phlebitis or infiltration. However, the review was published before any randomised controlled trials in this area were available, so the inclusion criteria were wide, including abstracts, letters and observational studies (Hoffmann et al., 1992). The most effective method for securing peripheral venous catheters remains unclear, so there is a need to provide guidance for clinicians by synthesise evidence from randomised controlled trials on the efficacy of devices and dressings that are used to secure peripheral catheters.

2. Objective

To assess the effects of peripheral venous catheter dressings and securement devices on the incidence of peripheral venous catheter failure.

3. Methods

We included randomised controlled trials or cluster randomised trials (where the cluster represented randomisation at the ward or hospital level), comparing different dressings or securement devices for the stabilisation of peripheral venous catheters. Cross-over trials were ineligible for inclusion, unless data for the first treatment period could be obtained. Participants included any patients in any setting who required a peripheral venous catheter. The intervention of interest was any dressing or securement device that was compared with another dressing or securement device, for the protection or stabilisation of a peripheral venous catheter. Dressings or securement devices that were made from any type of product (e.g. polyurethane, gauze) were eligible. Our primary outcomes of interest were catheter failure (defined as any reason for the unplanned removal of the catheter); and adverse events associated with the dressing or device. Our secondary outcomes included the incidence of specific reasons for catheter failure (e.g. dislodgement/accidental removal; phlebitis; infiltration; occlusion); time to catheter failure and costs.

3.1. Search strategy

In April 2015 we conducted structured searches in the following electronic databases: the Cochrane Wounds Group Specialised Register (searched 8 April 2015); the Cochrane Central Register of Controlled Trials (CENTRAL; 2015, Issue 3); Ovid MEDLINE (1946 to March 7, 2015); Ovid MEDLINE (In-Process & Other Non-Indexed Citations, March 7, 2015); Ovid EMBASE (1974 to March 7, 2015); and EBSCO CINAHL (1982 to March 8, 2015). For the search strategy used in the Cochrane Central Register of Controlled Trials, refer to Supplementary material Table S1. We adapted this strategy to search Ovid MEDLINE, Ovid EMBASE and EBSCO CINAHL. We combined the Ovid MEDLINE search with the Cochrane Highly Sensitive Search Strategy for identifying randomised trials in MEDLINE: sensitivity- and precision-maximising version (Lefebvre et al., 2011). We combined the EMBASE search with the Ovid EMBASE filter developed by the UK Cochrane Centre (Lefebvre et al., 2011). We combined the CINAHL searches with the trial filters developed by the Scottish Intercollegiate Guidelines Network (SIGN, 2011). We did not restrict studies with respect to language, date of publication or study setting. We searched the following clinical trials registries: ClinicalTrials.gov (http://www.clinicaltrials.gov/); WHO International Clinical Trials Registry Platform (http://apps.who.int/trialsearch/Default.aspx); and EU Clinical Trials Register (https://www.clinicaltrialsregister.eu/). We searched the reference lists of all relevant publications we retrieved for other studies that had not been identified by the search methods described above.