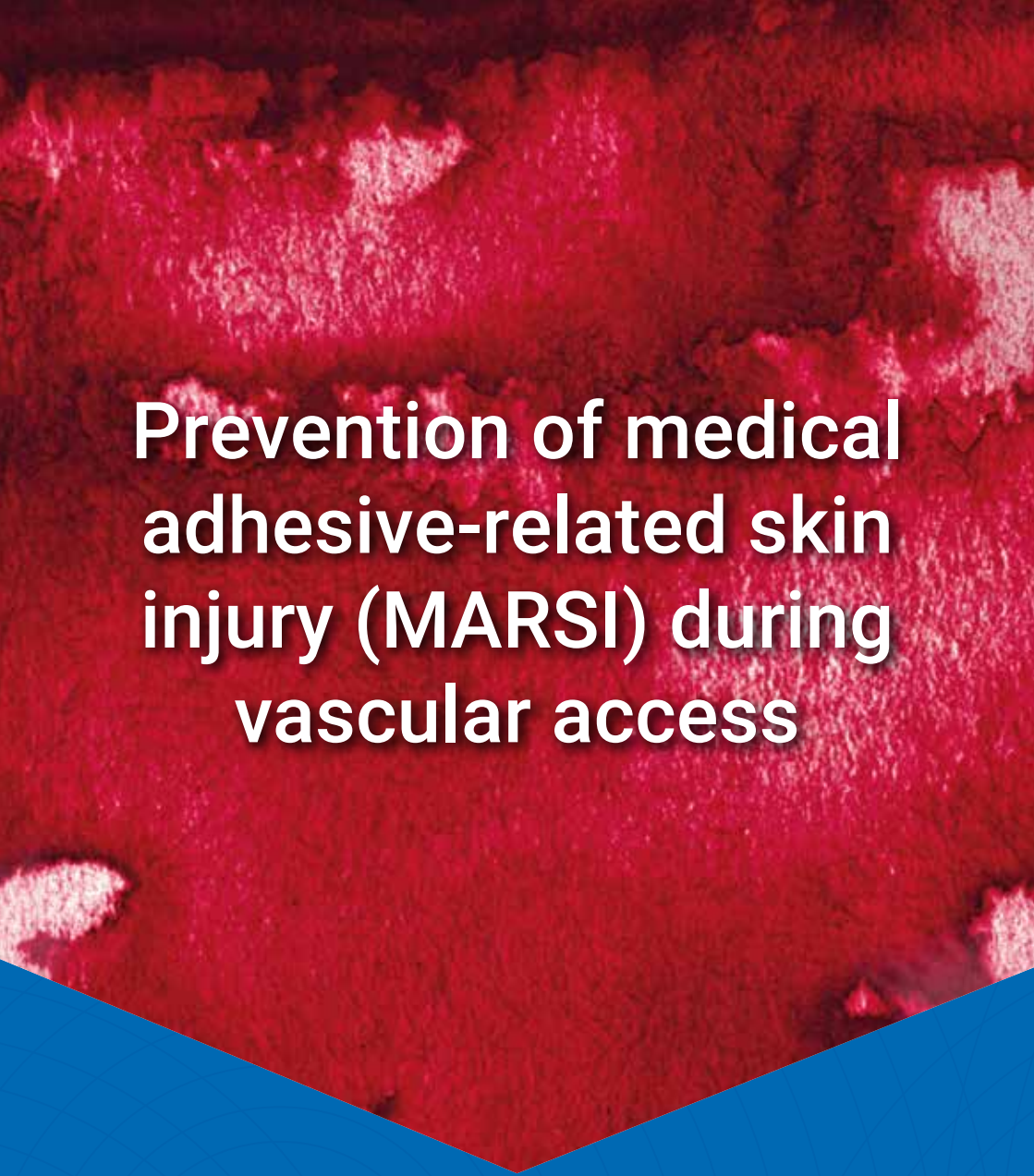

Prevention of medical adhesive-related skin injury (MARSI) during vascular access

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The use of film dressings around a vascular access device (VAD) can result in medical adhesive-related skin injury (MARSI). This skin damage can create a portal for microbial entry and contamination, increasing the risk of localised and even systemic infection. Prevention of MARSI is therefore an important consideration during the insertion and maintenance of VADs, particularly given the large number of patients in the UK (60%) requiring vascular access (Hadaway, 2012).

This guide explores the causes and effects of MARSI in patients requiring vascular access and outlines strategies for its prevention.

How can MARSI cause bloodstream infection?

Catheter-related bloodstream infection (CRBSI) can be defined as a bloodstream infection arising from the use of a central venous access device (CVAD) when no other source of infection is present (Royal College of Nursing (RCN), 2016). It is a common complication of VADs. The bacterial contamination that causes CRBSI can occur in the internal lumen of the catheter (intraluminal infection), which provides a direct pathway into the bloodstream, and/or on its external surface (extraluminal infection) (*Figure 1*). The contamination is usually due to:

- Poor practice during manipulation of the needle-free connector or
- Migration of pathogens from the catheter exit site along the outside surface of the catheter (Inagaki and El-Feghaly, 2019).

In the UK, it has been estimated that the treatment costs for each patient episode of CRBSI is between £5000 and £15000 (Thokala et al, 2016)

What are the signs of localised infection?

The skin irritation and abrasions caused by MARSI can create an environment under the film dressing that is conducive to infection (Han et al, 2010). The first sign of a catheter-related exit-site infection is usually redness (erythema),

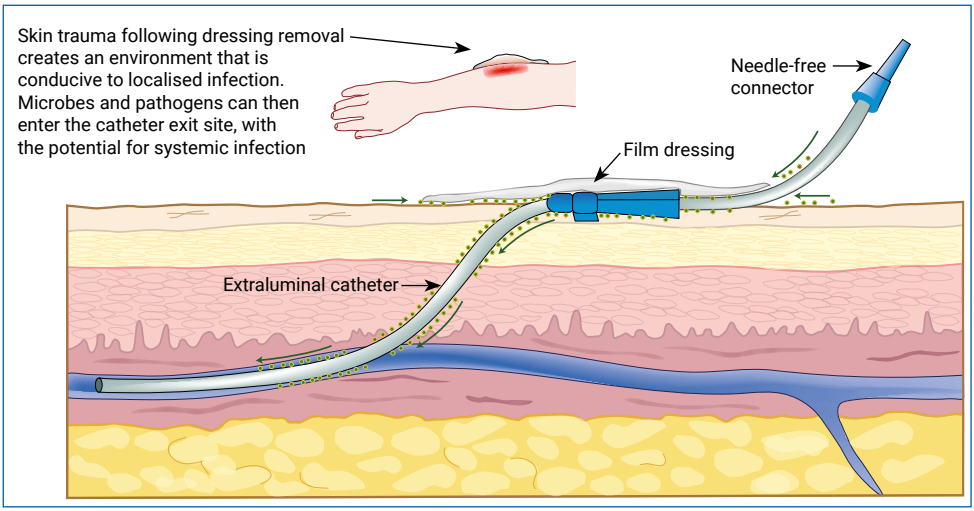

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Figure 1. Catheter exit-site infection

followed by pain and localised swelling (oedema) around the catheter exit site (Brooks, 2016). These signs are usually indicative of phlebitis (*Figure 2*). Three types of phlebitis are associated with VAD: mechanical, chemical and bacterial. The latter occurs when pathogens enter the bloodstream or lumen via the broken skin under the dressing and/or at the catheter exit site. All three types can be avoided with good VAD insertion technique, adherence to care bundles and provision of robust care (Mihala et al, 2018).

How are CRBSIs detected?

Intraluminal catheter infections are usually detected when there are signs of systemic infection, such as hypotension, high temperature and positive blood cultures (Curran, 2016).

Reducing the risk of infection

There is a wealth of evidence supporting a correlation between the good care and maintenance of VADs and the reduction of VAD-related infection and other complications (RCN, 2016; Loveday et al, 2014).

Care bundles can help promote best practice in the care and maintenance of VADs and reduce infection rates when fully implemented (Padilla Fortunatti, 2017). *Box 1* lists the basic components of a VAD care bundle.

The most effective way to reduce the risk of VAD-related infection is to regularly decontaminate the skin surrounding the catheter exit site and then cover the device with a semipermeable, vapour-permeable film dressing, ensuring that the area of decontaminated skin is larger than the film dressing (Frasca et al, 2010). Once in place, the dressing should be left undisturbed for 7 days, unless debris is visible under the dressing or the dressing starts to come away from the skin (RCN, 2016).

However, removal of medical adhesives, including film dressings, from unprotected skin can result in damage to the outermost layer of the skin. Repeated injury can result in inflammatory skin reactions, local oedema and soreness, which can further reduce the skin's barrier function, with the risk of local or systemic infection (Fumarola et al, 2020).

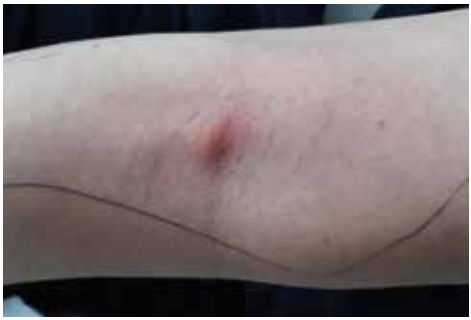

Figure 2. Vascular access device exit-site infection: phlebitis (inflammation of the vein) can be seen at the exit site, with erythema on the surrounding area

Box 1. Components of a care bundle approach for the safe use of vascular access devices (McGuire et al, 2019)

Insertion date
Catheter insertion details: • Type of catheter used • Location of the insertion site • Length of the indwelling catheter • Length of the external catheter • Person who inserted the device
Decontamination of the needle-free connector before and after flushing
Regular assessment to ensure that: • The film dressing is clean and intact • There are no signs of phlebitis • The catheter is patent and flushing without complication • The catheter is still required
Removal of catheter as soon as it is no longer needed

For an illustration of safe application and removal techniques for film dressings used with VADs, please see Fumarola et al (2020)

What are MARSI and how to avoid them?

Given that the securement of VADs involves some form of medical adhesive, there is a risk of MARSI, and thus compromised skin integrity, at removal (Hadfield et al, 2019). Unfortunately, MARSI is an under-recognised (albeit common) complication of vascular access (Fumarola et al, 2020).

In 2020, *Journal of Wound Care* (*JWC*) published an expert opinion consensus document on the prevention of MARSI (Fumarola et al, 2020). Some of its key recommendations are summarised below:

- MARSI is a term used to define any skin damage related to the use of medical adhesive products including film dressings
- This type of injury is largely avoidable
- MARSI is rarely reported, so the true incidence is unknown
- Anyone requiring application of an adhesive medical device to the skin is at risk
- Education on the prevention of MARSI needs to be made more widely available
- Good skin care, along with the use of skin barriers and medical adhesive removers, can help to significantly reduce the risk of MARSI.

Table 1 (overleaf) outlines the types of MARSI associated with the use of VADs.

What is skin stripping?

This can occur when film dressings, tapes and adhesive securement devices used to secure and protect VADs are removed without care. Factors such as extremes of age, nutritional status, underlying clinical conditions and chronic illness can predispose individuals to skin injury, despite careful removal of these products (Fumarola et al, 2020).

Skin stripping is one such injury, which can occur when one or more layers of the epidermal layer of the skin becomes detached from the dermal layer during the removal of an adhesive dressing or medical device. This injury occurs when the attachment between the skin and adhesive is stronger than the attachment between the different layers of the skin (*Figure 3*).

Role of sterile silicone medical adhesive removers

The *JWC* MARSI consensus document recommends the use of medical adhesive removers to avoid skin damage when removing intravenous (IV) film dressings and IV catheter securement devices, based on clinical judgement as part of a risk assessment strategy (Fumarola et al, 2020). Medical adhesive removers are available in sterile and non-sterile options, with sterile silicone medical adhesive removers provided in a range of formats (wipes, foam applicators, liquid sachets and sprays) and non-sterile versions as sprays and wipes. When used in the care and maintenance of VADs, these medical adhesive removers must be single-use and *sterile* to protect the catheter exit site from microorganisms (Fumarola et al, 2020).

The anatomical location where the medical adhesive remover will be applied should influence selection—for example, avoid using sprays above the neck and use liquid sachets with caution where there is a risk that the contents might enter the body

Strategies for preventing MARSI in vascular access should therefore include raising awareness and understanding of this form of skin damage, ensuring that the skin is prepared correctly before the adhesive device is applied (by allowing skin-cleansing agents to dry

Table 1. Vascular access devices associated with MARSI

	Type	Cause	Result	Implications for vascular access	Prevention strategy
Mechanical	Skin stripping	Removal of adhesive tape or dressing	Removal of one or more layers of the epidermis (top layer of the skin). Damage is often shallow and irregular in shape. The skin may appear shiny. Open sores may be accompanied by red skin and blister formation	This can occur with all VADs, film dressings and adhesive securement devices. This can occur when removing VAD film dressings or adhesive securement devices. It can also occur if central VADs are secured inadequately, with insufficient secondary support for heavy lumens and attached IV lines. Children and patients who are confused or agitated can pull VADs, which can damage the skin	Use of a sterile silicone medical adhesive remover
	Tension injury or blister	Skin swells or stretches under an unyielding adhesive tape or dressing Poor application of medical adhesive tape or dressing A joint or another area of movement is covered with an unyielding tape	Injury caused by shear force (separation of the epidermis from the dermis, which is the second layer of the skin)		Use of a sterile silicone medical adhesive remover
	Skin tear	Skin cuts or scrapes (shearing) Rubbing (friction)	Skin is pulled away and the layers of the skin separate. This can cause either a partial-thickness wound (one that extends into the epidermis and dermis) or a full-thickness wound (one that extends into fat and muscle layers)		Use of a sterile silicone medical adhesive remover
Dermatitis	Irritant contact dermatitis	Response to contact with a chemical irritant in the adhesive	The skin is inflamed (red) and can become blistered, dry, thickened and cracked Injury caused by shear force	It is recommended that, at dressing changes, the area around the VAD exit site should be cleansed with chlorhexidine. However, this can contribute to skin injuries, especially if the area is not allowed to dry before a new film dressing is placed over the device	Use of a sterile silicone barrier film before application of adhesive products

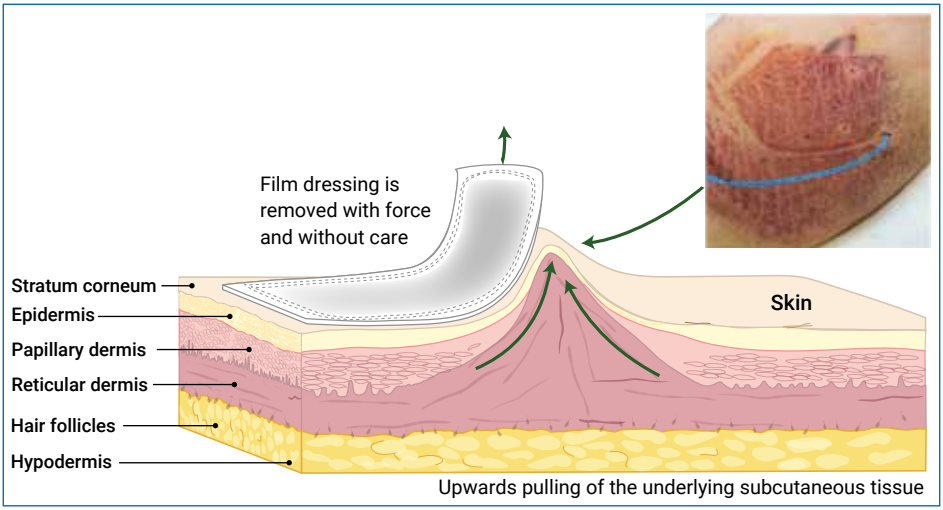

Figure 3. Skin stripping: an injury caused when the skin-to-adhesive attachment is stronger than the skin-to-skin attachment

completely before dressing application and using film barriers) and incorporating medical adhesive removers into the VAD care bundle.

For patients with sensitive skin, or who are at risk of or have a MARSI, a sterile barrier film can be used to protect the skin from irritation caused by the adhesive on a medical device. Sterile barrier films can be applied with a foam applicator for precision. Again, this needs to be incorporated into the care bundle. *Box 2* summarises best practice for using medical adhesive removers.

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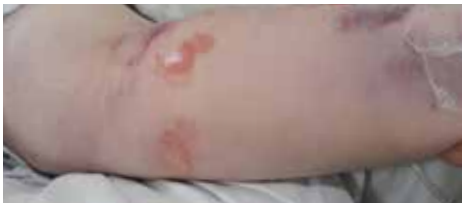
Other	Maceration	Skin damage resulting from prolonged accumulation of moisture under an adhesive tape or dressing	Skin appears wrinkled and white or grey. Softening of skin increases its permeability and susceptibility to infection	When showering or washing with a film dressing in place over the VAD, patients should consider using a shower guard or changing the dressing as soon as it gets wet to avoid injury. The vascular access site and film dressing should be regularly monitored and the dressing changed when required	Use of a sterile silicone barrier film before application of adhesive products and a sterile silicone medical adhesive remover
	Folliculitis	Prolonged accumulation of moisture and heat under an adhesive can attract bacteria, which might proliferate in this enclosed environment, resulting in an inflammatory response in the hair follicle	Appears as a small inflamed elevations of skin around the hair follicle. These can present as papules (skin that has changed colour or texture) or pustules		

IV– intravenous; VAD–vascular access device *Source: Fumarola et al (2020)*



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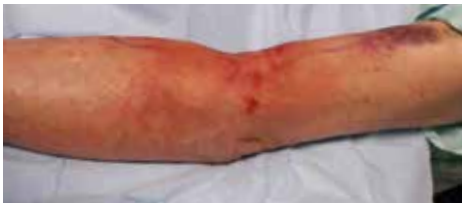
Tension injury/blistering: distension of skin under the adhesive dressing creates shear forces that lead to the separation of the epidermis from the dermis



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Irritant contact dermatitis: occurs following contact with a chemical irritant. The area of irritation often correlates to the area of skin covered with a dressing

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Skin tear: removal of an adhesive medical device has created shearing, friction and/or blunt forces, resulting in the skin layers being torn; skin tears can be partial or full thickness

Box 2. Sterile silicone medical adhesive removers: points for practice

- Ensure the product is opened in accordance with the manufacturer's guidance
- Ensure the hands are washed and clean, and that gloves are worn before using the product
- If a liquid adhesive remover is being used, ensure the face, eyes and mouth are protected from splashes
- Remove adhesive devices and/or dressings slowly, starting from one corner and moving to the centre, using the medical adhesive remover to gently release the adhesive

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