Catheter-Associated Skin Injury: Integration Of MARSI Principles Into Vascular Access

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The seminal work of McNichol et al. has been foundational in standardizing the identification and classification of medical adhesive-related skin injury (MARSI).[1] This foundational research, along with subsequent studies, has provided invaluable general guidance for the prevention, management, and treatment of various integumentary issues related to adhesives across diverse health-care settings.[2] However, despite these advancements in wound care, there remained a lack of specific recommendations concerning vascular access device (VAD) sites, particularly when faced with conditions analogous to MARSI.

Addressing this unmet need led to the development of a novel clinical algorithm: CVAD Skin Impairment (CASI).[3] The term 'Central Vascular Access Device (CVAD)-Associated Skin Injury' was adapted from 'Medical Adhesive-Related Skin Injury' (MARSI) to more comprehensively describe compromised skin integrity associated with the myriad products used in vascular access care, such as medical adhesives, catheters, securement devices, needle-free connectors, etc.[4,5] This algorithm, which provides a standardized approach to identifying and managing VAD-related skin injuries, has been instrumental in the recognition and adoption of the term 'catheter-associated skin injury' (CASI) in prominent Canadian and international best practice guidelines.[4,5]

The Canadian Vascular Access Association defines catheter-associated skin injury (CASI) as: *Disruption of the skin, characterized by drainage, skin irritation (irritant or allergic contact dermatitis [e.g., erythema, vesicle, bulla, pruritis]), skin damage (erosion or skin tear, blister, stripping) at a VAD site, under the dressing*

area, which lasts longer than 30 minutes after dressing/securement removal (excluding skin conditions such as eczema, autoimmune disorders, extravasation); CASI may result in patient discomfort, delays in treatment, unscheduled VAD removal and replacement, and increased healthcare costs.[4]

This article outlines how prevalent this issue is, the evolution of the CASI algorithm (Figure 1) and discusses key interventions to provide targeted guidance for the assessment, management and prevention of wounds occurring at vascular access device sites.

Prevalence And Types of Vascular Access Skin Injuries

Vascular access catheters are frequently associated with various skin complications, posing a significant clinical challenge. Various studies report diverse prevalence rates and types of skin injuries, highlighting the complex and persistent nature of these complications, as well as the need for a comprehensive and standardized approach to prevention, assessment and management. Overall prevalence rates of skin impairment at CVAD sites have been reported to range from 3.23% to 36%.[6-11] Table 1 summarizes the reported prevalence and types of catheter-associated skin injury.

Environmental Scan Of CVAD Skin Impairment Management

Despite the recognized prevalence of skin complications associated with vascular access devices, early literature specifically addressing the identification and management of such impairment at these critical sites was limited. Pioneering discussions on vascular access site impairment were initiated by Thayer and Kutzcher, who highlighted the often-overlooked aspect of skin integrity in this context.[12,13] Their contributions helped to lay the groundwork for understanding that maintaining skin integrity at vascular access sites is often a secondary consideration to establishing access and preventing infection. This early work pointed to the need for greater awareness and a more systematic approach to recognizing and managing skin reactions to dressings, adhesives and securement devices used around vascular access, setting the stage for more comprehensive research in this area.

Author DB received a plea from her sister as their young son battling cancer and multiple transplants developed an exit-site infection with no change in plan of care.[14] A brief literature review revealed this lack of available evidence to support optimal care in the context of skin injuries. Building upon these observations and the recognized gap in evidence, an international survey conducted by Broadhurst, Moureau and Ullman in 2016 specifically aimed to determine current central venous access device (CVAD) site care practices across 34 countries.[15] This study revealed significant global inconsistencies in CVAD site care, impacting skin integrity at insertion sites. Clinicians showed varied preferences for dressing products based on impaired site conditions, such as redness, rash, skin stripping or drainage. For example, when faced with skin stripping/adhesive-related injuries, clinicians showed a notable shift from transparent dressings towards hydro-colloid dressings (23.3%), gauze with adhesive borders (17.7%), or other unspecified dressings. Inconsistencies were also noted in fundamental management approaches, such as adapting various antiseptic solutions for sensitive skin. A critical finding revealed that only a small percentage (11.4%) of organizations had formal procedures or algorithms for managing CVAD sites with impaired skin integrity. This broad lack of standardized institutional guidance often leads to reliance on individual clinician judgment.[15]

CASI Algorithm: A Comprehensive Framework

Following the revelation of significant inconsistencies in CVAD site care practices and a notable paucity of literature guiding the management of impaired skin integrity,[15] the World Congress of Vascular Access (WoCoVA) initiated the development of the first comprehensive evidence and consensus-based algorithm specifically designed for the management of Central Venous Access Device-Associated Skin Impairment (CASI). (See Figure 1).[3]

Table 1: Reported Prevalence and Types of Catheter-Associated Skin Injury

Prevalence Metric	Reported Rate	Source (Author, Year)
Overall Skin Impairment at CVAD Sites	3.23% to 36%	Chan et al., 2017; Ullman et al., 2019; Wang et al., 2019; Zhao et al., 2018; Liu et al., 2022
CVAD-associated skin complication	27% (n=168/626)	27% (n=168/626)
Incidence rate per 1,000 CVAD-days	30 skin complications	Gavin et al., 2024
Skin complications with peripheral venous/arterial devices	12.3% (46.2 per 1,000 catheter days)	Ullman et al., 2019
Skin complications with CVADs	11.7% (22.5 per 1,000 catheter days)	Ullman et al., 2019
CASI at PICC Sites (Oncology Patients)	19.70% to 33.99%	Wang et al., 2018; Zhao, He, Huang, et al., 2018; Zhao, He, Wei, & Ying, 2018; Li, Zhang, Zhang, Hou, & Feng, 2023; Tian, Yin, Zhu, & Zhang, 2021
MARSI in outpatients	14.7%	Xia, Chen, Ma, & Zhang, 2025
Specific CASI Types		
Local infection (PICC CASI)	56.1%	Li, Wang, Liu, & He, 2020
Skin injury (PICC-related)	40.8%	Wang, Miao, & Wan, 2023
- Dermatitis	63.1% (of skin injury)	Wang, Miao, & Wan, 2023
- Mechanical skin injuries (blisters, pressure injuries)	36.9% (of skin injury)	Wang, Miao, & Wan, 2023
Blisters/vesicles (CVADs)	3% (of participants)	Gavin et al., 2024
Skin tears (CVADs)	2% (of participants)	Gavin et al., 2024
Skin stripping (CVADs)	1% (of participants)	Gavin et al., 2024
Mechanical injuries (overall MARSI)	70.3%	Frota et al., 2023
- Skin stripping (of mechanical injuries)	41.3%	w et al., 2023
- Skin tears (of mechanical injuries)	26.1%	Frota et al., 2023
Contact dermatitis (PICC sites)	9.31%	Zhao et al., 2018
Contact/allergic dermatitis (CVADs)	<1%	Gavin et al., 2024
Pruritus (itch) (CVADs)	34%	Gavin et al., 2024
Pressure injuries (CVADs)	<1%	Gavin et al., 2024

CVAD- central venous access device, PICC- peripherally inserted central device

Figure 1: CVAD-Associated Skin Impairment Algorithm

CVAD– Associated Skin Impairment (CASI) Algorithm

1. Assess Patient

EXIT SITE INFECTION
Redness, induration (hard), and/or tenderness within 2 cm of the catheter exit site; possibly with other signs and symptoms of infection, such as fever or purulent drainage at exit site, concomitant bloodstream infections

SKIN INJURY
- Stripping: Shallow irregular lesions; shiny skin
- Tears: Partial or full thickness tension blisters

SKIN IRRITATION/CONTACT DERMATITIS
Skin color change (red, dark, shiny, dull) persisting 30 min. after dressing change (often mimics shape of dressing) and/or burning, itchy skin and/or lesions (macules, papules, vesicles, bullae)

WEEPING/OOZING
(Non-infectious)
Assess color, consistency, odor, amount and location of exudate

2. Protect Skin and Provide Comfort

If Exit Site Infection is Suspected:
- Culture site and draw blood cultures
- Collaborate with practitioner; may need to remove catheter
- Topical antimicrobial agent† (based on culture results) or consider non-CHG antimicrobial dressing
- If there is no resolution with topical therapy or it is accompanied by purulent drainage, start systemic antibiotics
- Consider cauterizing exuberant granulation tissue at site of long-term CVAD

†Confirm compatibility with dressing and catheter

- Consider non-alcohol antiseptic agent
- If skin flap present, approximate viable skin flap edges prior to dressing application

- Rule out infiltration/extravasation, thrombophlebitis and other skin conditions (e.g., eczema, impetigo)
- Identify and avoid suspected irritant:
  - Change type/concentration of cleansing solution (see Fig. 1)
  - Ensure solution and barrier film are allowed to dry fully before dressing application
  - If no resolution, change brand/type of dressing
  - Consider open application test of dressing/antiseptic solution on unaffected skin (see Fig. 2)

- Control bleeding: pressure at site, alginate and/or hemostatic agent under dressing
- Apply non-alcohol barrier film and absorbent dressing

- Apply alcohol-free barrier film and appropriate dressing
- Consider anti-inflammatory, anti-pruritic agents and/or analgesics; cool compresses (applied on top of dressing)
- Assess irritated skin every 24 hrs; monitor for signs and symptoms of infection
  - If no improvement to sites with suspected contact dermatitis, consider short-term use of topical corticosteroid (do not apply directly on exit site
- If no improvement within 3–7 days, consult wound/skin specialist

- Educate staff and/or patients/caregivers on proper dressing selection, atraumatic application/removal, site care
- Identify patients at risk and take precautions with site care (e.g., malnutrition, dehydration, elderly/neonates, dermatologic conditions, low/high humidity, radiation therapy, medications [chemotherapy, anti-inflammatories, including long-term corticosteroid use, anticoagulants])

Dressing Usage Guide for CVAD Skin Impairment Management

Dressing*	Skin Injury (e.g., tear/blister)	Skin Irritation	Drainage			Able to see site
			Low	Med	High	
Non-adherent non-woven gauze** (if skin intact or topical agent applied)		▯	▯			
Transparent film		▯				Yes
Absorbent clear acrylic	▯	▯	▯	▯	▯	Yes
Hydrocolloid (do not apply directly on CVAD exit site)		▯	▯	▯		
Foam (silicone or low-tack)	▯	▯	▯	▯	▯	
Alginate (also has hemostatic properties)	▯			▯	▯	
Skin glue (2-octylcyanoacrylate alcohol-free topical bandage) + Cover Dressing	if skin flap is present					Yes
Antimicrobial dressing***			▯	▯	▯	

- Apply sterile alcohol-free skin barrier film prior to dressing (let dry before applying dressing)
- If skin damage/drainage is away from the exit site, isolate wound and exudate from exit site: apply absorbent dressing over area of injury and transparent dressing over exit site and prepped skin.
- If exudate leakage, use a different dressing with higher fluid handling capacity

*Stabilize catheter with securement device/dressing
**Does not provide a microbial barrier
***Assess manufacturer's contraindications. Recommend consult wound/skin specialist and/or physician.

Fig. 1–Reaction to CHG w/ Alcohol

Try CHG w/o alcohol
↓
No improvement?
↓
Try Povidone Iodine
↓
No improvement?
↓
Try sterile normal saline

Fig. 2–Open Application Test

1. Apply product to forearm
2. Monitor for 30-60 min.
3. Reassess in 3-4 days for signs of dermatitis

Reprinted with permission from the Canadian Vascular Access Association. Broadhurst D, Moureau N, Ullman AJ; The World Congress of Vascular Access (WoCoVA) Skin Impairment Management Advisory Panel. Management of central venous access device-associated skin impairment: an evidence-based algorithm. J Wound Ostomy Continence Nurs. 2017;44(3):211-220.

This groundbreaking work aimed to standardize the identification and diagnosis of impaired skin around CVAD sites, guide clinical decision-making, and enhance clinician confidence in managing these complex conditions.

The development of the CASI algorithm was a multi-stage process.[3] It commenced with a comprehensive scoping review of existing literature, mapping current research and identifying critical gaps related to CVAD site care and skin impairment management. This review informed an international advisory panel, comprising 16 clinicians and academics with diverse expertise in wounds, vascular access, pediatrics, geriatrics, home care, intensive care, infection control and acute care.[3] Leveraging a 2-phase, modified Delphi technique, the panel reviewed and critiqued the available evidence. Phase 1 involved open-text surveys on algorithm components, followed by panel discussions to collaboratively construct entry points, assessment tasks and decision nodes for CASI management. Phase 2 entailed electronic distribution of the draft algorithm providing a visual representation of CASI practice recommendations for final consensus and feedback, culminating in a 93.7% approval rate.[3]

The final phase was external validation of the algorithm, using a pre- and post-test design with 25 nurses in Canada, Australia, the US and New Zealand. The external validation of the CASI algorithm demonstrated its effectiveness in significantly improving clinician confidence in the assessment and management of a) skin injury, b) skin irritation/contact dermatitis and c) non-infectious exudates.

A high majority of participants found the algorithm easy to understand, comprehensive, time-saving, and recommended its use to others, underscoring its practical utility in clinical settings.[3]

CASI Management: Assess, Protect, Comfort

The CASI algorithm is structured to guide health-care professionals through a systematic approach to identifying and managing four most commonly seen skin impairment conditions associated with CVADs, as identified by the working panel: 1) exit-site infection; 2) skin injury (including skin stripping, skin tears and tension blisters); 3) skin irritation (irritant or allergic contact dermatitis); and 4) weeping/oozing (non-infectious drainage).[3]

The algorithm is not intended for conditions unrelated to CVADs or those requiring more complex interventions, such as tunnel infections. Its utility is primarily for direct CVAD care providers (generalist and vascular access nurses) and those consulted for CASI management (wound care specialists, physicians).[3]

The management of catheter-associated skin injury is guided by a systematic approach encompassing three domains: a) assessment, b) skin protection and c) patient comfort.[3] Table 2 provides a summary of recommended interventions and their goals, derived from both the original CASI algorithm and recent publications. As CASI evidence evolves, clinicians are advised to use a standardized process or tool for CASI management and prevention, such as the CASI Algorithm or Li et al's assessment tool (2022) and Xu et al's CASI classification tool.[3,4,11,16,17]

Management OF CASI

Initial assessment of CASI requires a thorough evaluation of the patient and the VAD site. This includes inspecting skin integrity, noting exudate characteristics and ruling out other dermatological conditions.[3-5] When CASI is present, a risk-benefit analysis should be performed to determine if catheter salvage or removal is warranted. Whenever possible, management of CASI associated with a peripherally inserted central catheter (PICC) should be undertaken without removing the device, to avoid interrupting therapy.[18]

Interventions are then focused on promoting skin healing and preventing further injury. Key strategies include identifying and eliminating the cause of the skin damage through product substitutions and using atraumatic dressing removal techniques, such as the 'low-and-slow' method for bordered dressings or the lateral stretch method for non-bordered dressings.[19]

Chlorhexidine 2% with 70% alcohol is the preferred agent for intact skin.[4,5] When skin is broken or chlorhexidine is a suspected irritant, consider aqueous CHG (alcohol-free), a reduced CHG concentration (0.5%), or povidone and lastly sterile saline, allowing for greater drying time.[3-5] A product open application patch test can help determine potential irritants.[3-5] An alcohol-free skin barrier film should be applied to dry, intact skin before a new dressing to act as a protective interface.[1,4] For broken or wet skin, an alternative skin protectant may be necessary.[19]

While a transparent semi-permeable dressing is the standard of care, an alternate dressing may be required to manage skin injury and exudate. If feasible, the wound should be isolated from the VAD exit site, with a separate dressing (e.g., silicone mesh) applied to the wound area to promote healing and drainage absorption (e.g., foam, acrylic clear, alginate, hemostatic).[4,5,19,20] Soft silicone dressings are considered atraumatic as their non-stick wound contact layer allows for easy removal without causing skin damage and are designed to remain in place for up to a week.[21] A novel clear silicone adhesive dressing, which has an option integrated with chlorhexidine and silver, provides another choice for both managing and preventing CASI.[22] Figure 2 provides illustrations of some alterative dressing approaches for management of CASI. Typically transparent dressings are changed at a minimum of weekly and gauze dressings at least every 48 hours.[4,5] As the goal is to minimize dressing change frequency to facilitate skin healing, if a non-transparent dressing is applied, the clinician may consider leaving the dressing in place up to seven days if able to assess site through palpation and signs and symptoms of discomfort or complications.[4] Patient comfort is addressed concurrently (see Table 1) with skin protection, recognizing the impact of skin damage on quality of life.[3]

Minimizing Risk: The Foundation Of CASI Prevention

Effective prevention of CASI is paramount to mitigating its significant impact on patient outcomes and health-care costs (see Figure 3). Prevention strategies begin with optimizing VAD insertion through to site assessment for prompt recognition of early signs of CASI; staff education (e.g., proper application and removal techniques, application of dressing to dry skin, use of skin barrier films); pressure prevention strategies (e.g., soft silicone foam dressing [preferred] or gauze beneath devices at VAD site as a cushioning barrier for patients at risk of pressure injuries)[21] and patient education.[3-5] These measures, combined with the use of standardized assessment and prevention tools, contribute to a comprehensive anti-CASI approach. Finally, organizations are encouraged to implement quality improvement measures to monitor and address CASI incidence,[4-5] including continuous monitoring of current evidence, and participation in further research activities related to CASI prevention and management.

Figure 2: Examples of Dressings for CASI Management

A. Wound isolated with segment of foam dressing (to absorb drainage and protect/heal injured skin) and covered with transparent dressing

B. Wound isolated with segment of silicone dressing (to protect/ heal injured skin) and covered with transparent dressing

C. Site covered with transparent dressing with wound isolated with separate foam dressing

D. Site covered with foam/silicone dressing with cut in dressing to accommodate catheter; cover with transparent dressing

Figure 3: CASI Impact and Prevention Model

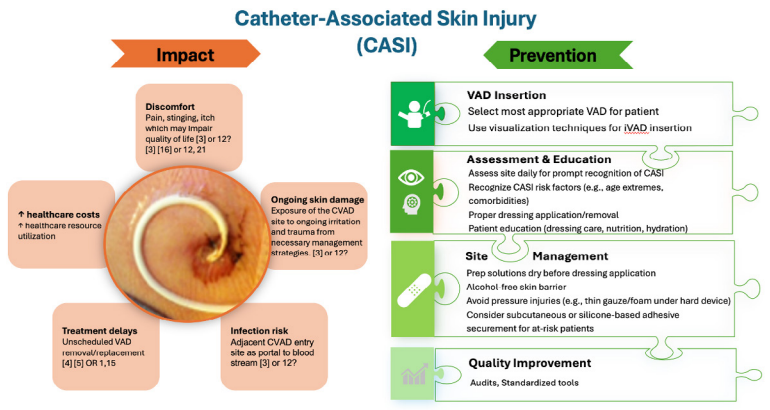
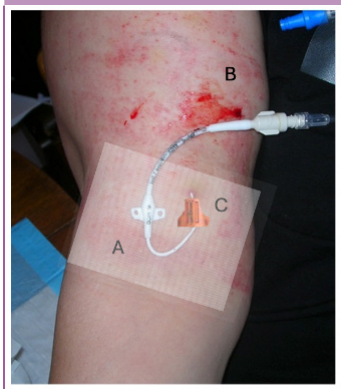


Table 2: Management of Catheter-Associated Skin Injury (CASI)

A. CASI Type Domain	Skin Condition(s) Length of Product Use	Skin Symptoms Symptom Location	Improvement Timeline Frequency of Product Use
CASI (all types) ASSESS	• Thorough patient - site assessment[4,5] - Skin inspection (colour, texture, integrity)[4,5] - Exudate characteristics[4,5] - Use standardized assessment tool[4,5,9-11] - Risk and causative factors affecting skin health • Rule out other conditions[4,5] • Swab for infection (if suspected)[4,5] • Patient history (allergies)[4,5]	• Routine assessment crucial (e.g., every shift/visit)[4,5] • Education on assessment vital[4,5] • Consider an objective classification system for skin-tone description (as skin tone may impact early recognition of symptoms)	• Appropriate and prompt problem identification and management • Accurate diagnosis
PROTECT SKIN	• Atraumatic dressing removal (low & slow/ stretch;[13] alcohol-free adhesive remover[4,5] or sterile NaCl[13] • Antisepsis: - Aqueous CHG / 0.5% CHG / PVI / sterile NaCl (for broken skin or CHG-alcohol sensitivity)[4,5,13] - Adequate antiseptic drying time[4,5] • Alcohol-free skin barrier film before dressing[4,5] • Dressing selection to absorb exudate and promote wound healing;[4,5,13,14] isolate wound from VAD site if possible[4,5] • Minimize device pressure; reposition catheter/ device prn[4] • Consider catheter salvage vs removal[4,5]	• Sterile NaCl for cleaning • Avoid barrier film under CHG gel/disc; consider alternate product if skin broken (e.g., Cavilon TM Adv. Skin Protectant)[13] • Increase monitoring if no securement[4] • Alternative securement (e.g., subcutaneous, integrated[4,5] splinting, vests) • Proper hydration/nutrition[4,5] • Staff/patient education key[15]	• Protect skin- prevent skin breakdown • Restore skin integrity • Protective interface between skin and adhesives (barrier film) • Prevent CASI, including pressure injuries • Resolve infection
COMFORT	• Assess/document pain (validated tools)[4,5] • Administer pain relief (local/systemic)[4,5] • Cool compresses (for pruritus/irritation)[4,5] • Anti-inflammatory/anti-pruritic agents[4,5] • Refer to specialist (if unresponsive/ deteriorating)[4,5]	• Assess and document pain consistently • Short-term low-mod topical steroids for contact dermatitis (if no improvement)[4,5,14]	• Alleviate discomfort • Improve QOL

CASI Wound Management - Example



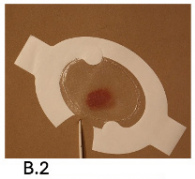
(Original photo courtesy of Deb Thayer, RN)

Isolate wound from VAD site (if feasible)

A) Erythema (no drainage)
Silicone mesh dressing protecting erythematous skin; cover with transparent dressing adhered to healthy skin if possible OR transparent silicone dressing

B) Broken skin and/or drainage
B.1 Silicone foam dressing* OR
B.2 Acrylic clear absorbent dressing* OR
B.3 Hemostatic dressing (e.g., alginate) if bleeding*
May cut segment of adhesive dressing border to prevent covering catheter site, if feasible
B.4 Transparent dressing applied over catheter site-may cover non-bordered wound dressing


B.1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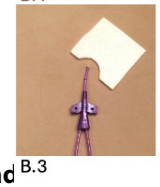
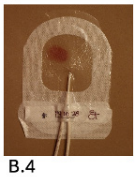

B.3


B.4

C) Consider subcutaneous securement device or siliconead
prevent dislodgement (may add silicone material under subcutaneous securement base)

Abbreviations: Adv: Advanced, CHG- chlorhexidine gluconate, PHMB- polyhexamethylene biguanide, PVI- povidone iodine, QOL- quality of life.

B. CASI Wound Management	
CASI Condition	**Intervention** (in addition to previously stated general interventions)
1. Erythema; Inflammation; Skin damage (no drainage)  (e.g., Contact dermatitis, Skin stripping, Tension blister)	• Identify and correct the cause if contact dermatitis suspected[3,4,5] - Open application skin test (e.g., application of suspected product to anterior forearm; intrascapular) - Monitor patch test (30-60min, then 3-4 days); remove product if dermatitis develops - Substitute antiseptic agent (if indicated; alcohol is an irritant)[4,5] - If mild redness, use alternate brand of transparent dressing • Silicone mesh covered with transparent dressing[13,14] or silicone transparent dressing • If no improvement in inflammation/pruritis[3,4,5] - Low-to-moderate potency topical steroids (avoid applying non-sterile agent directly adjacent to catheter exit site; for short-term use) - Topical/systemic agents (analgesic/antihistamine) - Cold compresses *Goals:* Stop inflammatory cycle; prevent epidermal breakdown; reduce adhesive trauma, Relieve inflammation and itch
2. Exudate  (e.g., Contact dermatitis; mechanical skin injury)	• Absorbent dressing - Silicone-based or foam[13,14] - Acrylic clear absorbent dressing[3,4,5] - Hemostatic dressing for bleeding (e.g., StatSeal, alginate) (control bleeding first)[3,4,5] • Isolate wound from exit site with second dressing if feasible;[4,5] apply transparent dressing over non-bordered non-transparent dressing • Change dressing weekly +PRN (assess by site palpation if non-transparent dressing) *Goals:* Manage exudate; prevent epidermal breakdown; maintain VAD integrity while addressing wound
3. Local Infection  (e.g., Exit site infection; cellulitis)	• Antimicrobial dressing[3]/disc[13] (e.g., CHG, silver, PHMB) with absorptive properties if drainage present (confirm no contraindications on product instructions for use)[3,4,5] • Culture site and draw blood cultures[3] • Collaborate with medical team[14] • Consider catheter salvage vs removal[4,5] • Topical antimicrobials (e.g., mupirocin/ketoconazole /lotrimin based on culture)[3] • Systemic antimicrobial therapy if no resolution or purulent drainage[2] *Goals:* Manage local pathogens; reduce microbial load; resolve infection
4. Skin Tear - viable flap 	• Realign flap (with moist cotton tip applicator)[3,4,5] • Secure flap with tissue adhesive[3] / silicone mesh;14 do not use adhesive strips or hydrocolloid dressing[3] • Apply absorbent clear acrylic/ silicone foam or alginate dressing (if bleeding)[3,4,5,22] • Transparent dressing over non-bordered non-transparent dressing (e.g., alginate)[13,14] *Goals:* Promote re-approximation and wound healing

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Translating Knowledge into Practice

The CASI algorithm, alongside the best practice recommendations from the Canadian Vascular Access Association (CVAA), [4] the Infusion Nurses Society (INS)[5] and the Association for Vascular Access (AVA; in development), represent critical resources available to health-care organizations. To facilitate the adoption of these recommendations, the CVAA, INS and AVA guidelines provide structured, step-by-step guidance for the assessment, management and prevention of CASI. Notably, the CVAA Guidelines, explicitly encourage organizations not only to integrate these recommendations but also to reproduce CVAA recommendations and figures verbatim, fostering a standardized and optimized approach to managing CASI.[4] Consequently, clinicians are encouraged to incorporate these recommendations and the CASI Algorithm into vascular access-related organizational policies, procedures, clinical guidelines and training, and to post the Algorithm as an effective visual clinical practice tool.

Advancing CASI Science: Research Implications

It is a significant achievement to now have a defined term identifying this complication and published clinical guidelines addressing the management and prevention of CASI, reflecting the burgeoning evidence addressing its care. Building on this progress, efforts continue to advance our understanding of CASI, exemplified by a recent study proposing a refined classification system for these conditions.

A recent consensus panel validated a novel CASI classification tool.[17] We agree with the authors' recommendation to expand the classification tool to include pressure injuries. Pressure from securement devices, the catheter, hub or suture wing and add-on devices, such as needle-free connectors, may cause skin injury due to persistent local pressure on the skin.[21] The authors also altered the category CASI 'skin injury' to 'mechanical injuries,' in alignment with MARSI definitions,[1] both of which include skin stripping, tension injury or blister and skin tears. An etiology category added to this tool was 'complex clinical presentation' to account for sites with more than one of these CASI conditions.[17] The term 'skin irritation' was used in the original CASI algorithm as consensus panel members opined that the generalist nurse may be unfamiliar with the term 'contact dermatitis'. However, given the widespread familiarity with MARSI and increasing uptake of CASI framework, the more formal identification of 'contact dermatitis' seems appropriate. Another difference is that the newer CASI classification system changed the term 'exit site infection' to local infection, to incorporate cellulitis and folliculitis, which we also support.

Future research is needed to validate a CASI Management tool which addresses the recommended revised classification system to capture:

- Contact dermatitis
- Mechanical injuries
- Local infection
- Device-related pressure injury
- Complex clinical presentation.[17]

Opportunities for future research in CASI are critical to addressing current gaps in evidence and practice. Health economic studies are needed to examine the costs associated with inappropriate dressing and securement choices, their resulting complications, and impact on treatment plans and hospital length of stay.[23] Furthermore, randomized controlled trials are required to investigate the effectiveness of various dressing and securement products.[20] Developing valid and reliable assessment and management tools that encompass all types of CASI is also crucial for advancing care, including the evaluation of effective management strategies[3] and modifiable and non-modifiable risk factors.[23]

Additionally, the recent MARSI update panel indicated further investigation is warranted into the use of steroids and systemic chemotherapy as independent risk factors for medical adhesive-related skin injuries (MARSI), alongside a need to evaluate the safety profiles of skin protectants and adhesive removers, particularly in neonatal and geriatric populations.[2]

Conclusion

In conclusion, catheter-associated skin injury (CASI) represents a significant complication in vascular access care, impacting patient comfort, treatment efficacy and health-care costs. The development of the evidence-based CASI algorithm, a product of international consensus and expert collaboration initiated by the World Congress of Vascular Access (WoCoVA),[3] marks a pivotal advancement in addressing this challenge.

The algorithm provides a structured, step-by-step framework for the comprehensive assessment, proactive prevention and effective management of CASI, spanning crucial domains of patient assessment, skin protection and comfort.[3] Its utility extends beyond direct patient care, serving as a foundational resource that has been integrated into the guidelines of prominent professional organizations, including the Canadian Vascular Access Association and the Infusion Nurses Society.[4,5] This broad recognition facilitates the widespread adoption of CASI principles.

Health-care organizations and clinicians are actively encouraged to incorporate the CASI algorithm and CASI practice recommendations into their internal policies, procedures and clinical guidelines. By enabling the verbatim reproduction of recommendations and figures, as explicitly supported by the CVAA,[4] guideline recommendations support consistent and standardized practice. Ultimately, the systematic application of the CASI algorithm empowers clinicians to enhance patient outcomes, improve the quality of vascular access care and advance the overall standard of skin integrity management in clinical settings. Continued adherence to these best practices and ongoing evaluation will be essential to further mitigate the impact of CASI.

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