INFORMATION BRIEF (RAPID REVIEW)

Vein Finder

Malaysian Health Technology Assessment Section (MaHTAS)
Medical Development Division
Ministry of Health Malaysia
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Rapid Review
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TITLE: VEIN FINDER

PURPOSE

To provide scientific evidence on the effectiveness, safety and cost-effectiveness of vein finder following a request from the Deputy Director of Medical Practice Division, Ministry of Health, Malaysia.

BACKGROUND

Establishing peripheral venous access is one of the most frequently performed clinical procedures across all healthcare settings. However, achieving successful cannulation can be challenging, particularly in certain populations such as neonates, young children, obese individuals, and patients with chronic illnesses or fragile veins. In these cases, traditional methods of vein location using palpation and visual inspection often result in multiple failed attempts, leading to increased patient discomfort, procedural delays, and a higher risk of complications such as phlebitis, hematoma, and infection.[1,2]

To address the limitations of traditional intravenous (IV) access techniques, particularly in patients with difficult intravenous access, various adjunctive technologies have been developed, most notably, vein visualization devices, commonly referred to as vein finders. These non-invasive tools assist healthcare professionals in locating peripheral veins by enhancing vein visibility, thereby improving first-attempt success, reducing procedural time, and increasing patient comfort. Vein finders are claimed to be especially useful in neonates and preterm infants with fragile veins, pediatric patients with limited cooperation, obese individuals, and emergency situations requiring rapid access.[3]

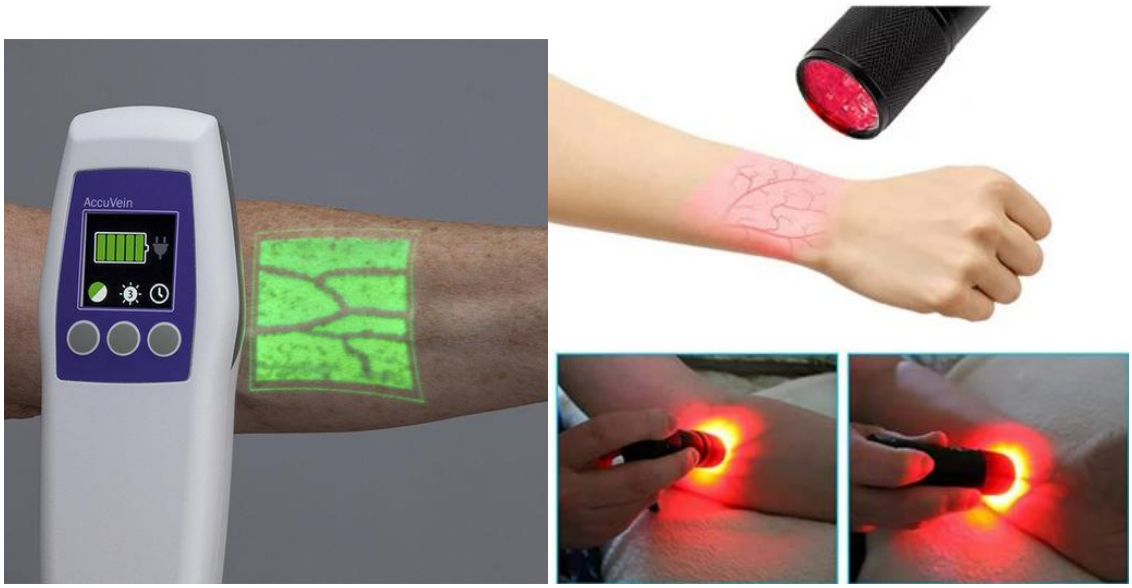

Figure 1. Common vein visualization devices

The most common type of vein finder operates on the principle that deoxygenated hemoglobin in venous blood absorbs near-infrared (NIR) light, while surrounding tissues do not. This differential absorption is processed to produce a real-time image of the vein structure, which is projected onto the patient's skin to guide cannulation more accurately.[3,4] Widely used NIR devices include the [redacted] and [redacted], which are US FDA-approved and globally available. In addition to NIR-based devices, other technologies include LED-based transillumination, which is particularly useful in neonatal and pediatric settings by backlighting small veins in limbs or the scalp.[5] Ultrasound-guided devices offer visualization of deeper or central veins but require trained operators, while newer projection-based or augmented reality systems overlay vein maps directly on the skin surface for enhanced guidance.[5]

Vein finders are typically indicated in situations involving difficult intravenous access (DIVA), such as in neonates and preterm infants with fragile or deep veins, pediatric patients with anxiety or limited cooperation, obese adults where veins may not be palpable, and emergency scenarios where rapid vascular access is required. They are also increasingly used in healthcare education and training to enhance the learning process for junior healthcare personnel.[6,7] The claimed benefits of vein finders include increased first-attempt success rates, reduced procedure time, fewer needle sticks, and improved patient satisfaction. Some studies also suggest that the use of such devices may decrease the need for escalation to central venous access in difficult cases.[4] Despite these potential advantages, the clinical effectiveness of vein finders remains inconsistent across different populations, with some randomized trials showing no significant benefit in first-attempt success in general pediatric or emergency populations.[8,9]

While most literature focuses on efficacy, concerns have also been raised about the safety of vein finders, particularly regarding thermal effects or skin injury during use. In light of a recent incident reported in a Malaysian hospital involving a burn injury in a neonate following the use of a vein finder, this rapid review was commissioned to evaluate the safety and effectiveness, of vein visualization devices.

EVIDENCE SUMMARY

A total of 143 titles were retrieved from the scientific databases via OVID, PubMed and general search engines [Google Scholar], using the search term; *Veins/ or Venipuncture/ or Phlebotomy, Vein finder, vein imaging, vein illuminator, vein visualization, and vein locator.* The last search was conducted on 13th June 2025. Eight articles were found to be relevant and included in this review which comprised of one rapid review, five randomized controlled trials, one evidence briefing and one observational study.

EFFICACY/ EFFECTIVENESS

Uğraş Arıaslan et al. (2024) conducted a prospective randomized controlled study to assess the effect of an infrared vein finder (IVF), specifically the [redacted], on fear of pain (FOP) and pain intensity during peripheral venous catheterization (PVC) in adults at an

emergency department in Türkiye. The study enrolled 200 adult patients, randomly assigned to either the IVF group (using [redacted] or the control group (conventional technique). Patients completed the Fear of Pain Questionnaire-3 (FPQ-3) before the procedure and the Numeric Rating Scale (NRS) afterward. The results showed that the IVF group had significantly lower minor pain-related fear scores and slightly lower total FOP scores compared to the control group (p=0.025), though there were no significant differences in NRS pain scores (p=0.121) or first-attempt success rates (92% IVF vs. 97% control). The IVF device did not significantly reduce fear of severe or medical pain, and no adverse events or safety concerns were reported. The authors concluded that while infrared vein finders may reduce fear of minor pain, they do not significantly reduce actual pain or improve catheterization success in adults, and are possibly more effective in pediatric settings.[10]

Rosendahl et al. (2023) conducted a randomized controlled trial to evaluate whether using the [redacted] near-infrared vein viewer improves the first-attempt success rate of peripheral intravenous (IV) cannulation in pediatric patients. The study was carried out in a tertiary pediatric hospital in Denmark and included 418 children aged 0–18 years, randomized into two groups: standard technique vs. standard technique[redacted]. The primary outcome was first-attempt success rate, and secondary outcomes included time to successful cannulation, number of attempts, and pain assessed using validated pediatric pain scales. Results showed no statistically significant difference in first-attempt success rate between the [redacted] group (67%) and control group (63%) (p = 0.37), nor in time to cannulation, number of attempts, or pain scores. The authors concluded that while the [redacted] is safe and easy to use, it did not improve IV access outcomes in children and thus may not be clinically beneficial in general pediatric settings.[11]

The study by Al-Saadi et al. (2022) was a randomized controlled trial conducted to evaluate the effectiveness of near-infrared (NIR) vein finder technology in improving the success rate of intravenous cannulation in obese diabetic patients. The trial included 92 participants from Al-Rusafa hospitals in Baghdad, Iraq, randomly allocated into an intervention group (which used the NIR device) and a control group (routine cannulation). The primary outcomes measured were first-attempt cannulation success and procedural time. The results showed a significantly higher first-attempt success rate in the intervention group (60.9%) compared to the control group (15.2%), and a significantly shorter mean procedural time (53.2 ± 28.9 seconds vs. 94.3 ± 41.5 seconds; P < 0.001). Additionally, patient BMI and skin color independently influenced cannulation time. The authors concluded that NIR technology enhances venous access success and reduces cannulation time and number of attempts in challenging patients like those with obesity and diabetes.[12]

Francisco et al. (2021) conducted a prospective, observational engineering-evaluation study to develop and assess a low-cost, real-time near-infrared (NIR) vein finder prototype for improving peripheral subcutaneous vein selection during venipuncture, particularly for clinical laboratory testing and student training. The study had two main phases: development of a CMOS-based infrared imaging device using 960 nm NIR LEDs, and in-vitro human testing on 242 volunteers at two anatomical sites (arm and dorsal hand), without tourniquet application. Key variables included age, gender, BMI, skin tone (Fitzpatrick scale), and arm circumference. Results showed that the device achieved 100% visibility on dorsal hand sites and 94.21% visibility on arm sites, significantly improving vein detection across BMI categories, darker skin tones, and larger arm sizes. Only 5.79% of participants showed non-

visible veins in the arm, often due to factors like deep vein location or stretch marks. Although no formal safety outcomes were assessed, the study reported no adverse events; the device's non-contact design and use of low-energy NIR light were highlighted as features supporting safe use. The authors concluded that the device is an efficient, real-time guiding tool for cannulation and a cost-effective alternative to commercial systems, with applications in both clinical practice and medical education.[13]

Alizadeh (2021) conducted a randomized clinical trial in Iran to compare the impact of vein finder devices versus conventional venipuncture on anxiety and physiological indicators in 62 hospitalized children aged 3–6 years. The intervention group used a vein finder device (type not specified) during IV catheter insertion, while the control group received standard technique. Anxiety was assessed using the Yale Preoperative Anxiety Scale (YPAS), and physiological parameters (heart rate, respiratory rate, blood pressure, and oxygen saturation) were recorded pre- and post-procedure. The intervention group showed significantly lower post-procedural anxiety scores (mean 13.77 vs. 18.00, $p<0.001$), lower heart and respiratory rates, and more stable physiological responses compared to controls. No significant differences were observed in blood pressure and oxygen saturation between groups. The authors concluded that the use of vein finder devices is associated with reduced anxiety and improved physiological stability during IV insertion in young children, making it a safe and effective tool for pediatric wards.[14]

The Canadian Agency for Drugs and Technologies in Health (CADTH, 2016) conducted a rapid review to evaluate the clinical effectiveness, cost-effectiveness, and practice guidelines surrounding the use of vein illumination devices such as [redacted] and [redacted] for vascular access in neonates and emergency department patients. This review incorporated one systematic review with meta-analysis, eight randomized controlled trials, and three non-randomized studies. Devices were assessed for their effectiveness in improving cannulation outcomes compared to standard methods, with mixed findings: several studies showed no overall improvement in first-attempt success rates, time to cannulation, or number of attempts, although subgroup analyses indicated potential benefits in infants with greater gestational age and children under two. The review found limited evidence supporting their routine use across settings, and only one guideline was identified, which concluded there was insufficient evidence to recommend vein illumination devices for difficult IV access in emergency departments. The authors concluded that while near-infrared vein illumination may help in specific pediatric subgroups, current evidence does not support widespread adoption in all populations.[15]

UK National Institute for Health and Care Excellence (NICE) (2016) produced evidence briefing to summarise the available evidence on the use of infrared vein visualization devices such as [redacted] for improving peripheral venous access in patients with difficult venous access (DVA), particularly in pediatric, obese, or chronically ill populations. The document synthesized findings from nine randomized controlled trials, one non-randomized trial, and two systematic reviews, covering both pediatric and adult settings. Results were mixed: some studies reported improved first-attempt success and reduced cannulation time in children and neonates, while others showed no significant benefit. There was also no clear evidence that these devices consistently reduce pain or complications. However, the evidence quality was considered low to moderate due to study limitations. The authors concluded that while infrared vein visualization devices may offer clinical benefit in

selected high-risk patient groups, their routine adoption was not supported by current evidence and cost-effectiveness data were lacking.[16]

A prospective study by Chiao et al. (2013) investigated the impact of patient characteristics on peripheral vein visibility and evaluated the effectiveness of an infrared vein-finder device [redacted]) compared to conventional methods. In a prospective randomized trial involving 384 patients of varying age, ethnicity, BMI, and skin color, each participant underwent vein assessment via both conventional eyesight and the infrared device. Results showed that obesity, dark skin, and certain ethnicities (notably African-American and Asian) were linked to fewer visible veins under normal eyesight. However, the infrared device significantly increased the number of visible veins across all subgroups (from an average of 5.8 to 9.1), with the greatest improvement seen in difficult cases such as infants and obese patients. The authors concluded that the infrared vein finder is a useful, non-invasive tool to enhance IV cannulation, especially in patients with characteristics associated with poor vein visibility.[17]

SAFETY

In terms of safety, Uğraş Arıaslan et al. (2024) reported no adverse events in their study.[10] No adverse events or safety issues were reported in Rosendahl et al. (2023), and the device was well tolerated**.**[11] Similarly, there were no adverse events reported in Al-Saadi et al. (2022) such as hematoma or hemorrhage, indicating that the NIR vein finder is safe for use in this population.[12] Francisco et al. (2021) had no formal safety outcomes assessed, but the study also reported no adverse events; the device's non-contact design and use of low-energy NIR light were highlighted as features supporting safe use.[13]

Rapid review by The Canadian Agency for Drugs and Technologies in Health (CADTH, 2016) reported that fafety outcomes were variably reported but no serious adverse effects were documented across included studies.[15] Evidence briefing by NICE in 2016 did not identify formal safety concerns; no adverse events related to device use were reported, and the devices were described as non-invasive and well-tolerated.[16] While no direct safety outcomes were measured in Chiao et al. (2013), the authors reported no adverse events, and operators expressed no concerns about the device's use. The study implies potential safety benefits by reducing the likelihood of failed cannulation attempts, but these were not formally evaluated.[17]

Vein finder devices such as the [redacted] and [redacted] have received regulatory clearance from major authorities. In the United States, they are approved by the U.S. Food and Drug Administration (USFDA) as non-invasive Class 1 medical devices using low-energy lasers, with no serious adverse events reported in the MAUDE database.[18,19] In Europe, these devices carry the CE mark, indicating compliance with the EU Medical Device Regulation (MDR). In Malaysia, two vein finder devices are listed as registered with the Medical Device Authority (MDA): the [redacted] by Teepham Medical Sdn. Bhd. and the [redacted] by Emedhealth Sdn. Bhd., as shown on the MDA website.[19]

COST/COST-EFFECTIVENESS (If any)

There was very limited evidence on cost-effectiveness of vein finder devices. There is currently no formal cost-effectiveness analysis available for vein finder devices such as the [redacted]. Health technology reviews, including one by CADTH, have concluded that existing evidence is insufficient to justify their routine use based on cost-benefit considerations.[15] In terms of pricing, while prices vary widely depending on model, condition, and vendor, new vein finders like [redacted] units typically range between USD [redacted] equivalent to approximately RM [redacted]

CONCLUSION

Based on the review conducted, limited evidence suggests that vein finder devices particularly those using near-infrared (NIR) technology such as the [redacted] and [redacted] systems are generally safe, non-invasive, and well tolerated across adult and pediatric populations. Their effectiveness, however, appears to be population-specific. While several studies reported improved first-attempt success and reduced procedure time in patients with difficult venous access, such as neonates, obese individuals, and patients with dark skin, other trials especially in general pediatric or emergency department settings did not show significant clinical benefit over conventional methods. Importantly, no major safety concerns or serious adverse events were identified across the reviewed literature. From a regulatory standpoint, vein finders are approved by the U.S. Food and Drug Administration (USFDA) and CE-marked in Europe. In Malaysia, there are several vein viewer devices registered with the Medical Device Authority (MDA). However, no robust cost-effectiveness data were identified, and current evidence does not support the routine use of vein finders in all patient populations. Their use may be more appropriate in targeted clinical scenarios involving high-risk or difficult-to-cannulate patients.

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