Editorial

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The integrated short peripheral cannula: A new peripheral venous access device?

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Abstract

Short peripheral intravenous cannulas have different features, as they may be winged or non-winged, ported or non-ported, equipped or not with needle stick prevention and "blood stop" mechanisms, and integrated or not with preassembled extensions or preassembled needle free connector. In the current range of commercially available short peripheral cannulas, there is one device that is apparently associated with several clinical advantages. In fact, short peripheral cannulas with safety mechanisms, closed system, winged, non-ported, and equipped with preassembled extension and preassembled needle-free connector appear to be associated with prolonged dwell time, reduction of the incidence of several complications (infiltration/extravasation, dislodgement, phlebitis, infection, blood leakage), cost reduction, and increased satisfaction of patients and clinicians. To clarify the current terminology and to identify this device for future clinical studies, the authors advocate the use of the term "integrated short peripheral cannula." A rapid review of the current evidence suggests that this new device may have different clinical performance and different indications if compared to standard short peripheral cannulas. Though, the optimal clinical outcome can be achieved only when the device is inserted and maintained with proper protocols.

Keywords

Short peripheral cannula, peripheral access, peripheral venous access, integrated cannula, short peripheral catheter

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Introduction

The recently published Standards of the Infusion Nursing Society[1] consider three main types of peripheral venous access devices: (a) short peripheral intravenous catheters, (b) long peripheral intravenous catheters, and (c) midline catheters. The recent technological evolutions in this particular area of venous access suggest that the definition of short peripheral catheters (SPC) as proposed by INS—"*an over-the-needle catheter with a hollow metal stylet (needle) positioned inside the catheter, generally inserted in superficial veins*"—is comprehensive of devices that have different features and different clinical indications.

In fact, the very recent European recommendations on peripheral venous access, developed by a group of experts summoned by the WoCoVA Foundation[2] have noted that "*the category of SPC has become more complex, with the introduction in clinical practice of new, 'advanced' or 'integrated' SPC, characterized by new material (polyurethane rather than polytetrafluoroethylene), new design (large wing; pre-assembled extension; preassembled needle-free connector) and new strategies of protection of the operator (needle stick injury prevention and 'blood-stop' mechanisms). This new type of 'integrated' SPC is meant to be associated with less risk of phlebitis, easier securement, increased safety, and longer duration (up to one week and longer), compared to old-fashioned SPCs*."

The history of these "integrated" SPCs is not very old, since the first studies appeared in the literature not more than a decade ago. Interestingly, from the very beginning, a confusing terminology has impaired the possibility of recognizing these devices as something different from the standard SPCs. They have been named "integrated IV catheter systems,"[3] "compact closed systems,"[4] "integrated closed systems,"[4] "closed catheter systems,"[5,6]

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Table 1. Principal differences between standard SPC and integrated SPC.

	Standard SPC	Integrated SPC
Features	Safety or non-safety, open or closed system, winged or non-winged, ported or non-ported	Safety, closed system, winged, non-ported, preassembled extension, preassembled needle-free connector
Material	Polyurethane or polytetrafluoroethylene (Teflon)	Polyurethane
Expected duration	2–3 days	4–6 days
Clinical indication	Peripheral venous access required for limited period of time (<48 h): operating room, radiology suite, short infusions	Peripheral venous access required for several days, in hospitalized patients

SPC: short peripheral cannula.

"non-ported cannulas with incorporated extension set,"[7] "closed system peripheral IV catheters,"[8] "integrated closed IV catheter system,"[9] "winged cannulas,"[10] "closed peripheral catheters,"[11] "integrated peripheral IV catheter,"[12] "closed systems,"[13] "closed peripheral IV catheter device,"[14] "closed-system peripheral IV catheter with a built-in stabilization device and integrated extension set,"[15] and "closed integrated catheters."[16]

Some of these terms appear to be incomplete or misleading. For example, the term "closed system" has also been used for SPCs with some mechanisms of "blood control" (such as a bidirectional septum located in the catheter hub that prevents blood flow from the unconnected catheter),[17–20] but that do not fit within the proper definition of "integrated SPCs." In fact, closed system SPCs may have a wing for stabilization but they do not necessarily have preassembled extensions or preassembled needle free connector.

According to the wise definitions provided by Strauss et al.,[21] SPCs with special mechanisms that protect the clinician against accidental needlestick injury should be properly called "safety" catheters; SPCs with mechanisms that allow access with needleless devices but prevent blood leakage or pathogen entry are "closed" systems; SPCs with built-in extension tubing and needle-free connectors should be called "integrated" devices.

In practice, the features of passive and active safety for needle stick injury and control of blood reflux ("closed system") are largely diffused in many types of SPCs and sometimes explicitly required by local hospital policies.[22] Both these features are designed to protect healthcare workers: accidental needlestick injury and contamination with blood are associated with the risk of possible transmission of several pathogens, including B, C hepatitis and HIV. Blood control mechanisms were proven to be effective in reducing health care workers exposure in several studies.[6,8,17,18,23] In particular, Haeseler et al.[18] demonstrated that closed system SPCs effectively reduced blood leakage and contamination during insertion compared to open system SPCs (3.9% vs 14.3%). Similarly, Seiberlich et al.[17] demonstrated a superiority of closed system SPCs in eliminating blood exposure compared to open system SPCs (93.9% vs 19.1%). Similar results were shown by Bausone-Gazda et al.,[6] who found a clear advantage of using closed system SPCs for reducing blood exposure (0.7% vs 28.9%). Finally, Easterlow et al.[7] found a reduced incidence of needle stick injuries with closed system SPCs.

Other features may differentiate SPCs (Table 1). Most SPCs currently available are provided with a wing for better stabilization of the device. Wings are also known as "stabilization platforms," and they surely play an important role in favoring the optimal securement of the cannula.

One additional feature not considered by Strauss is whether the SPC is "ported" or "non-ported." The presence of a port enables the intravenous administration of drugs without disconnecting the infusion; on the other hand, the port is very difficult to decontaminate and often it is not possible to close it with needle-free connectors, so that a ported SPC is easily exposed to bacterial contamination.[20]

Many SPCs currently available on the market are winged, non-ported and equipped with "no-stick" and "blood control" mechanisms. But they cannot be considered "integrated" SPCs.

Why should we use an integrated SPC?

As explained above, the definition of "closed systems" is insufficient for "integrated" SPCs, which are consistently characterized by safety mechanisms for needle stick injury prevention, closed system ("blood control"), and a wing for stabilization, but which are also provided with preassembled extensions and preassembled needle-free connectors.

The main question is: does the "integrated" SPC (ISPC) deserve to be considered as a different peripheral venous access device if compared to the standard SPC? A rapid review of the available literature seems to support the contention that ISPCs are characterized by less risk of catheter failure and by more prolonged duration than standard SPCs. If this is true, it implies that ISPCs may have specific clinical indications.

Table 2. Evidence supporting integrated SPC.

Outcome	Clinical studies supporting the evidence
Reduction in insertion attempts	Bausone-Gazda et al.[6] (RCT)
Reduction in infiltration/extravasation	González López et al.[8] (RCT)
Increased dwell time	González López et al.[8] (RCT), Tamura et al.,[9] Neo et al.,[10] Penoyer et al.,[13] Guenezan et al.[16] (RCT)
Reduction in risk of dislodgement	Bausone-Gazda et al.[6] (RCT), Galang et al.[15] (RCT)
Prevention of blood leakage	Bausone-Gazda et al.[6] (RCT), Easterlow et al.,[7] González López et al.,[8] Galang et al.[15] (RCT)
Cost reduction	Bausone-Gazda et al.[6] (RCT), González López et al.[8] (RCT)
Reduction in phlebitis rate	González López et al.[8] (RCT)
Reduction in infection rate	Easterlow et al.,[7] González López et al.[8] (RCT)
Improved clinician satisfaction	McNeill et al.,[5] Bausone-Gazda et al.[6] (RCT), Galang et al.[15] (RCT)
Improved patient satisfaction/comfort	Easterlow et al.,[7] González López et al.[8] (RCT), Galang et al.[15] (RCT)

SPC: short peripheral cannula.

All the available literature invariably reports a superiority of ISPCs in terms of dwell time if compared to normal SPCs.[8–10,13,16] In a randomized study published in 2014, González Lopez et al.[8] demonstrated the superiority of ISPCs versus SPCs in terms of dwell time (median dwell time 137.1 h for ISPCs and 96 h for SPCs; $p = 0.001$): the probability that a standard SPC would last for 96 h was 79.9%, while the probability that a ISPC would last for 144 h was 80.4%. In this study, the Authors also found that the use of ISPCs reduced phlebitis rates by 29% (31 vs 45 cases/1000 catheter-days; $p = 0.004$); there was also a 20% relative risk reduction in catheter related infection. However, other clinical studies found no differences in terms of phlebitis and catheter related infections comparing between the two types of devices.[13,16] The increased dwell time is probably also related to the presence of the preassembled extensions, that allow to manage the infusion line without removal of the dressing.

In 2010, in a single center RCT, Bausone-Gazda et al.[6] compared the stabilization performance of ISPC with a specially designed dressing (study group) versus a non-winged SPC stabilized with an adhesive device (control group). Rates of catheter dislodgment were lower in the study group, estimated to be 2% (CI: 0%–7%) compared with 12% (CI: 7%–20%) in the control group for dwell times up to 96 h. Also, the number of insertion attempts (1, 2, 3, and >4) was significantly different in the two treatment groups (first attempt success rate of 90.7% with the investigational group compared with 82.2% with the control group) ($p < 0.036$). Moreover, staff satisfaction was 56% in the study group versus 36% in the control group ($p < 0.001$), and cost of the investigational stabilization system was approximately 75% of control.

More recently, the CLEAN 3 study[16] has shown that catheter failure occurred less frequently with ISPCs compared to normal SPCs, being 35% (172 out of 494 catheters) versus 48% (235 out of 495). Use of ISPCs versus SPCs was associated with reduced rates of catheter occlusion (4% vs 9%) and dislodgment (14% vs 19%), but there was no difference in terms of infiltration (14% vs 17%), phlebitis (2% in both groups), and local infection (<1% in both groups).

Though ISPCs cost more than standard SPC, their longer duration may probably yield economical savings or at least equal total expenses. In fact, González Lopez et al.[8] found significant cost savings (€786,257/year/1000 beds) using ISPCs rather than standard SPCs. On the other hand, Tamura et al.[9] found no difference in total cost per patient over 72 h ($21.00 vs $20.30) (Table 2).

One important bias of most of these studies is that—as acknowledged by the most recent guidelines[1,2]—the dwell time of any SPC or ISPC is also strongly dependent on the skills of the clinician, on the technique of insertion and on the appropriate strategy of management. Some aspects of SPC insertion are extremely important for the prevention of complication: proper choice of the exit site, skin antisepsis, securement, and protection of the device. Current evidence suggests that SPCs inserted in the forearm allow better stabilization and longer duration than SPC inserted in the antecubital fussa or on the hand[1,2]; infection prevention should include skin antisepsis with 2% chlorhexidine in 70% isopropyl alcohol[2,23]; optimal stabilization implies coverage of the exit site with semipermeable transparent dressing[2,23]; cyanoacrylate glue may further protect the exit site[2] and may improve SPC survival when the expected dwelling time is longer than 48 h.[24] In short, the key for a long duration of the cannula is not only the choice between ISPC or standard SPC, but also the adoption of a proper "insertion bundle" which must necessarily include the above strategies. In this regard, the most interesting and valid study is the CLEAN 3 study,[16] where the use of ISPC was associated with a consistent adoption of skin antisepsis with 2% chlorhexidine and coverage with transparent dressing. Of course, a proper "management bundle" is also mandatory: aseptic technique, use of the line only for peripherally compatible infusions, saline flushing of the

line when not in use, adequate surveillance of the dressing and of the exit site.

Conclusions

We propose to adopt the term "integrated SPC," which defines more closely this new type of SPC characterized by safety mechanisms, closed system, wing, preassembled extension and preassembled needle-free connector.

The evidence available in the literature suggests that these features are associated with extended duration of the line (even 6 days) if the catheter is inserted with a proper "insertion bundle" and if is properly managed. Therefore, ISPCs may have specific indications, as proposed in Table 1, if compared to standard SPCs. Specifically, ISPCs may not be indicated for short term use, that is, for less than 24–48 h, since their cost-effectiveness would be questionable: they should be preferably used in patients requiring a peripheral venous access for a longer period.

More studies are warranted to define the clinical performance of ISPCs if compared to standard SPCs (expected duration $<$ 4 days) and to long peripheral catheters (expected duration 2–3 weeks). Also, future studies in this area should investigate the clinical outcomes considering that the device should be used adopting proper insertion bundles and maintenance bundles.

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