Editorial

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International experts consensus on optimal central vascular access device selection and management for patients with cancer

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Abstract

Background: In patients with cancer, the choice of an appropriate venous access device is crucial for effective treatment, minimizing complications, and reducing healthcare costs. Key management decisions, such as the timing of device removal post-therapy, can impact clinical outcomes. As current international guidelines lack specific directives for these issues, a global consensus of experts, representing different countries, was deemed appropriate.

Methods: A panel of 11 experts from three continents, including oncologists and healthcare professionals, was chosen. After a comprehensive review of clinical trials and guidelines on central venous access devices (CVAD) in oncology published between January 2013 and December 2023, the panel developed and voted on specific recommendations for the selection and management of CVADs in patients with cancer, during a 2-day meeting.

Results: The panel reached consensus on 10 issues concerning (a) indications for a CVAD, (b) available options for CVADs, (c) role of the staff and patients in the choice of CVAD, (d) factors influencing the selection of a port over an external catheter, (e) logistical requirements for port and external catheter insertion, (f) stakeholders responsible for port and external catheter insertion, (g) factors determining the removal of a port after completing the definitive therapy, and (h) recommended frequency of flushing when the CVAD is not in use.

Conclusions: The results of the consensus may offer healthcare professionals a global view of some critical issues concerning CVADs for cancer therapy, helping to establish recommendations for local clinical practice.

Keywords

Central venous access device, peripherally inserted central catheter, femoral inserted central catheter, centrally inserted central catheter, totally implanted venous access device

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Introduction

The choice of an appropriate venous access device is crucial in oncology, impacting treatment efficacy, patient safety, and comfort.[1,2] The decision is based on several factors, including patient preference, cost efficiency, expected duration of access, characteristics of the chemotherapeutic agents to be administered, and the availability of trained clinicians.[3] In recent years, the prevalence of cancer has increased, and consequently an increasing number of patients with cancer are candidates for insertion of a central venous access device (CVAD) to facilitate intravenous administration of chemotherapy, immunotherapy, and blood products.[4,5] With the increasing availability of advanced diagnostic services, it is now easier to diagnose malignancies at an early stage, when they can be effectively treated.[6] The rise in cancer diagnosis owing to improved screening methods, combined with the adoption of newer therapies, has not only improved survival rates but also increased therapy duration and thus the use of CVADs for prolonged treatments.[7]

Annually, approximately 5 million CVADs are inserted in the USA,[3] indicating a potential surge in CVAD use. Several tools are available to guide the selection of the most appropriate venous access device in adults,[8–10] in children,[11–13] and neonates,[11,13–15] but limited literature focuses on oncology patients. The American Society of Clinical Oncology[16] and European Society for Medical Oncology[17] have previously provided recommendations for insertion techniques and the prevention and management of CVAD-related complications. However, advancements in medical technologies and methods during the past decade have impaired the validity of some of these considerations, which need to be updated. For example, the increasing adoption of ultrasound-guided (USG) venipuncture, non-radiological techniques of tip location (intracavitary electrocardiography, echocardiography), and improved strategies for infection and thrombosis prevention has dramatically decreased the cost of insertion and risk of complications, leveling the difference between ports and external catheters in terms of safety and cost-effectiveness. Further, new CVADs—such as tunneled non-cuffed central venous catheters—have been introduced. Also, a new terminology for the different CVADs has been proposed by the World Congress on Vascular Access (WoCoVA) Foundation[10,18] in agreement with the Global Vascular Access Network (GloVANet).[19] Although the Italian Association of Pediatric Oncology[20] has recently introduced guidelines for CVAD use, these focus exclusively on children with cancer. Moreover, the existing guidelines do not address several practical and logistic aspects, such as the choice between a port and an external catheter, or the role of clinicians in decision making and insertion.

Therefore, this report presents the recommendations of an expert consensus to provide a global perspective on key issues regarding CVADs in patients with cancer: decision making in the selection, maintenance, and removal of CVADs and the qualifications required for proper insertion and maintenance of the devices.

Material and methods

Guidelines on CVAD insertion and management in oncology patients often rely on low-level evidence, primarily due to a limited number of randomized controlled trials. Clinical practices vary widely among clinicians and hospitals in different countries, and they are often based on the opinion of local clinicians. Therefore, an international expert consensus was deemed the most suitable approach to develop and provide recommendations in this area.

A panel of 11 experts representing three continents—with members from Canada, USA, Italy, China, India, Japan, and Taiwan—were present, chaired by MJ and MP. Panelists were selected based on their expertise in different oncological fields, including medical oncology, pediatric oncology, breast surgery, cardiovascular and thoracic surgery, vascular surgery, surgical oncology, gastro-intestinal oncology, and oncology nursing, and on their competence in CVAD management, with consideration of their contribution as authors in the field. The demographics of the experts are provided in Table 1.

A literature search was conducted by a professional bibliographer, using PubMed and the Cochrane Library, to identify relevant literature (including clinical studies, guidelines, consensus documents) published in English between January 2013 and November 2023. Terms such as "venous catheter," "long-term venous device," "venous access device," "totally implanted venous access device," "tunneled catheter," "port," "PICC," "central line," were matched with terms such as "oncology," "malignancy," "cancer," "chemotherapy," "radiotherapy," and "hematological malignancy" were searched. The references of articles and previous meta-analyses were also examined to ensure that relevant studies not indexed in PubMed or the Cochrane Library were not missed. The bibliography was sent to the panelists before a 2-day in-person consensus meeting, which took place in December 2023. A pre-meeting questionnaire on CVAD selection and management practices, prepared by the chairpersons, was also sent to the panelists.

The consensus process followed a three-stage approach based on the RAND/University of California at Los Angeles Appropriateness Methodology.[21,22] During the live meeting, regional practices regarding CVAD indications and selection in oncology were discussed. After a collective discussion, the panel agreed to structure the recommendations as answers to 10 questions:

1. What are the indications for a CVAD in a patient with cancer?
2. What are the options for CVADs in a patient with cancer?

Table 1. Expert panel.

S. no.	Name	Specialty	Continents
1	Mohammad Jahanzeb	Medical oncology	USA
2	Ching-Yang Wu	Thoracic and vascular surgery	Taiwan
3	Howard Lim	Medical oncology	Canada
4	Kei Muro	Gastrointestinal oncology	Japan
5	Lichao Xu	Oncology	China
6	Manjiri Somashekhar	Pediatric surgery	India
7	Somashekhar	Surgical oncology	India
8	Xiaotao Zhang	Radiation oncology	China
9	Xiaoxia Qiu	Oncology nurse specialist	China
10	Ying Fu	Oncology	China
11	Mauro Pittiruti	Vascular surgery	Italy

3. Who should decide the type of CVAD to be inserted?
4. Which factors determine the selection of a port over an external catheter?
5. What are the prerequisites for the insertion of a port in terms of logistics?
6. Who should insert ports?
7. What are the prerequisites for the insertion of an external catheter in terms of logistics?
8. Who should insert external catheters?
9. Which factors determine the removal of a port after the completion of definitive therapy?
10. How frequently should a CVAD be flushed if not in use?

Preliminary statements answering the above questions were prepared by the chairpersons of the panel and then voted on by the 11 panelists. An online platform (Slido®) was used to conduct the voting during the consensus meeting. The nominal group technique was employed to deliberate, refine, and achieve consensus on the preliminary draft recommendations. Each initial recommendation was discussed on the basis of available evidence and clinical experience. Subsequently, there was a voting process; after the collection of suggestions for alternative wording, the discussion was concluded by a final vote. The strength of consensus for each statement was assessed based on the percentage of agreement, with >90% agreement regarded as a strong consensus. All statements were voted for by the 11 panelists, and only statements (or part of the statements) that achieved strong consensus were incorporated into the recommendations. Recommendations for each key question were subsequently drafted using standardized wording.[23] Special considerations addressed during the discussion were added as a commentary to each statement.

Following the meeting, an initial version of the consensus recommendations document was created, incorporating relevant evidence from the literature, voting results, and the key points discussed during the meeting. Some relevant guidelines and consensus documents published in the first 3 months of 2024 were also collected and shared with the panelists during the process of developing the final manuscript. The manuscript was reviewed by the entire panel for additional comments and final approval. The final statements voted by the panel with strong consensus (>90% agreement) are reported in Table 2.

Results and discussion

Question 1: What are the indications for a CVAD in a patient with cancer?

Background. Venous access devices are currently classified either as peripheral venous access devices (PVAD) or as central venous access devices (CVAD), depending on the position of the tip.[2,3]

A patient with cancer may require a CVAD in different phases of the clinical course: (a) in the peri-operative period (if surgical treatment is indicated), (b) during hospitalization for active/intensive treatments, (c) during outpatient chemotherapy, transfusions, and administration of other intravenous products, and (d) for palliative care at home or in hospice.[3,24] The selection of the most appropriate CVAD should be based on several considerations:

Irritant/vesicant drug properties: Infusion solutions are categorized as neutral, irritant, or vesicants based on pH, osmolarity, and other chemical properties. The administration of irritant/vesicant drugs via peripheral vascular access devices (VADs) may be associated with severe complications, such as extravasation, infiltration, phlebitis, tissue damage, and progressive depletion of peripheral veins. CVADs are highly recommended for infusion of any chemically irritating or vesicant drug to minimize the risk of peripheral phlebitis and extravasation.[24,25] The Infusion Nurses Society (INS) standards recommend central venous access devices for both boluses and continuous infusions of any vesicant drug.[3] An updated, detailed list of most intravenous drugs, classified as neutral/irritant/vesicant, is available in a recent document published by the Spanish Society of Clinical Pharmacology in collaboration with the Spanish Society of Venous Access and Spanish Society of Intensive Care.[25]

Duration and frequency of access: The indication for CVADs also depends on the planned duration of therapy (dwell time) and hospitalization status of the patient, as some devices have distinct features that make them suitable for non-hospitalized patients or prolonged use. CVADs are classified as short-term (few days or few weeks), medium-term (up to 3–4 months), and long-term VADs (>3–4 months),[6,24,26] as summarized in Table 3. Devices used every day, every other day, or on a weekly basis are

Table 2. Consensus statements regarding optimal use of central venous access devices in oncology.

1.	What are the indications for a CVAD in a patient with cancer? CVADs are recommended when infusing chemically irritating or vesicant drugs to reduce the risk of peripheral phlebitis and/or extravasation. Also, CVADs should be considered when there is insufficient peripheral venous access for the duration of the planned treatment or in the context of a failed or difficult peripheral intravenous access even with ultrasound guidance, despite the compatibility of intravenous infusion with the peripheral route.
2.	Which are the options for CVADs in a patient with cancer? Both external catheters (tunneled and non-tunneled CVADs like PICC, CICC, or FICC based on the insertion site) and totally implantable devices (ports including chest, brachial, and femoral ports) should be considered for patients with cancer, with the choice depending on patient needs, treatment duration, and clinical setting.
3.	Who should decide the type of VAD to be inserted? The selection of the most appropriate CVAD should be a collaborative process, involving the referring healthcare provider, vascular access specialists, patient, device maintenance team, and, when applicable, the patient's caregiver. The choice must be based on a comprehensive understanding of the patient's condition, the device and its insertion techniques, potential complications, and suitability of the device to the intended therapy and medications.
4.	Which factors determine the choice of a port rather than an external catheter? External catheters are preferred for medium-term vascular access (<3–4 months); they are also preferred for long-term (>3–4 months) frequent access (i.e. every day, every other day, or on a weekly basis). Totally implantable ports are preferred for infrequent long-term vascular access (>3–4 months duration, access every 2–3 weeks). It is advisable to select ports for patients living in environments with lower hygiene or privacy, given the easier maintenance and reduced infection risk with infrequent access. For patients with cosmetic concerns or those engaging in water activities, ports are preferred as they offer psychological advantages and less lifestyle disruption.
5.	What are the prerequisites for the insertion of the port in terms of logistics? The prerequisites for the insertion of a port in terms of logistic include (a) availability of the device and access to proper facilities, including essential equipment and supplies for asepsis, imaging, and monitoring devices, and effective management of biomedical waste and (b) availability of clinicians or specialized vascular access teams with specific training in venous access procedures.
6.	Who should insert the port? Healthcare professionals with specific and appropriate training within the regulatory framework of the relevant healthcare system should insert the port. This includes physicians (surgeons, interventional radiologist, anesthetists, oncologist, intensivist, any other physician duly trained), advanced practice clinicians (nurse practitioners, physician assistants), and staff nurses.
7.	What are the prerequisites for the insertion of the external catheter (PICC, FICC, and CICC) in terms of logistics? The logistical prerequisites for inserting an external catheter include device availability, provider and staff competence with specific training in VAD management, access to adequate facilities and appropriate equipment, and informed patient consent.
8.	Who should insert external catheters (PICC, FICC, CICC)? Healthcare professionals with suitable and specific training within the regulatory framework of the relevant healthcare system—including physicians (such as surgeons, interventional radiologists, anesthetists, oncologists, intensivists, and other duly trained physicians), advanced practice clinicians (like nurse practitioners and physician assistants), and staff nurses should insert external catheters.
9.	Which factors determine the removal of a port after the completion of definitive therapy? Ports must be removed after completion of the definitive therapy in cancers with a low risk of early relapse, based on minimal future vascular access needs and a favorable prognosis or treatment completion.
10.	How frequently should a central line be flushed if not in use? Ports should be flushed at intervals ranging from 4 to 12 weeks according to specific local protocols; external catheters require weekly flushing.

CICC: centrally inserted central catheter; CVAD: central venous access device; FICC: femorally inserted central catheter; PICC: peripherally inserted central catheter; USG: ultrasound guided.

usually considered "frequently" accessed; devices used every 2–3 weeks (as in a typical outpatient chemotherapy) are considered "infrequently" accessed.[3,8,24,27]

Limited availability of superficial veins: CVADs are also used when superficial veins are inaccessible owing to dehydration, aging, scarring, obesity, peripheral vascular disease, intravenous drug use, burns, vasoconstriction, exposure to cold, pregnancy, and other medical conditions.[3,17,27] USG peripheral VADs, such as long peripheral catheters or midline catheters, may be preferable in many cases if infusions are not potentially irritant or vesicant. However, if peripheral access is inadequate for the treatment duration or due to past difficulties or failures in establishing peripheral venous access, INS standards advise considering CVADs.[3]

Patient preference in terms of quality of life: CVADs are the preferred choice for outpatient care when repeated

Table 3. Indication of CVADs in different clinical settings.

Duration of access	Setting of healthcare	Frequency of access	Type of device
Short term (few days or few weeks)	Hospitalized patients	Frequent	Non-tunneled CICCs, non-tunneled FICCs
Medium term (up to 3–4 months)	Hospitalized or non-hospitalized patients	Frequent or infrequent	PICC, tunneled CICCs, tunneled FICCs
Long term (>3–4 months)	Non-hospitalized patients	Frequent	Tunneled CVADs
	Non-hospitalized patients	Infrequent	Totally implantable CVADs (ports)

CICC: centrally inserted central catheter; CVAD: central venous access device; FICC: femorally inserted central catheter; PICC: peripherally inserted central catheter.

intravenous infusions or frequent blood sampling are required over an extended period. They offer a better quality of life than peripheral VADs, which are more susceptible to local complications and require frequent access maneuvers.[3,10,24] CVADs should be considered when ambulatory chemotherapy is planned on an out-patient basis.[3,22] In palliative care, CVADs are also useful for delivering analgesics, sedatives, hydration, and other home-based infusion treatments.[3,28]

Ease of access for the operator: CVADs are convenient for the staff to manage as they allow direct access to the central circulation, multiple lumens for simultaneous infusions, compatibility with infusion pumps, ease of blood sampling, and reduced risk of complications compared to peripheral VADs. The difficulty experienced by healthcare personnel in inserting peripheral VADs is inevitably associated with the pain and discomfort of patients, particularly during prolonged treatment.[3,27,29–31]

Panel's recommendations. CVADs are recommended when infusing chemically irritating or vesicant drugs to reduce the risk of peripheral phlebitis and/or extravasation. Also, CVADs should be considered when there is insufficient peripheral venous access for the duration of the planned treatment or in the context of a failed or difficult peripheral intravenous access even with ultrasound guidance, despite the compatibility of intravenous infusion with the peripheral route.

Special considerations. Patients' quality of life should be also considered. CVADs are recommended for outpatient ambulatory chemotherapy, but also in palliative care settings, for administration of analgesics, sedatives, hydration, and other home-based infusion therapies.

CVADs offer ease of management for clinicians, providing direct central circulation access, multiple lumens for procedures, easier blood sampling, fewer complications than peripheral VADs, and reduced patient discomfort during prolonged treatment.

Question 2: What are the options for CVADs in a patient with cancer?

Background. Venous access devices are classified as PVAD or CVAD, the latter being further classified as external catheters or totally implanted venous access devices (TIVAD). External catheters may be tunneled or non-tunneled and include peripherally inserted central catheters (PICC), centrally inserted central catheters (CICC), or femorally inserted central catheters (FICC): they are used in both hospitalized and non-hospitalized patients. TIVADs (a.k.a. ports) include chest ports, brachial ports, or femoral ports: they are mainly used in non-hospitalized patients (Table 3).[1–3,24,32]

Thus, in hospitalized oncology patients, appropriate CVADs include non-tunneled CICCs and non-tunneled FICCs for short-term treatments (few days or few weeks) and PICCs, tunneled CICCs, and tunneled FICCs for medium-term treatments (3–4 months). Appropriate CVADs for non-hospitalized oncology patients include PICCs (tunneled or non-tunneled), tunneled CICCs, and tunneled FICCs for medium-term treatments (up to 3–4 months) and tunneled external catheters (PICCs, CICCs, or FICCs) and totally implanted ports for long-term treatments (>3–4 months; see Table 3).

Although ports have a low infection rate, the risk of infection increases with frequent access.[33–35] External catheters may be preferred in certain scenarios, such as in hospitalized oncology patients needing surgery, in hematopoietic cell transplantation recipients, in patients with acute leukemia (where multiple lumens are often warranted because of intensive intravenous treatments), or in palliative care (for easier infusion and blood sampling).[3,8] Hence, the choice of VAD should be based on the clinical setting, indication, and duration of use.

All CVAD insertions in adults and children should be performed by USG venipuncture, without exception, to reduce the number of attempts and minimize the risk of mechanical, thrombotic, and infectious complications.[36,37]

With regard to the insertion site, CVADs can be inserted in the supraclavicular area (by USG puncture of internal jugular, subclavian, deep tract of the external jugular, or brachiocephalic vein), in the infraclavicular area (by USG puncture of the thoracic tract of the axillary or cephalic vein), at the upper limb (by USG puncture of the basilic vein, brachial veins, or the brachial tract of the axillary vein), and at the lower limb (by USG puncture of the common or superficial femoral vein).[2,13,24,38] Access to the

supra/infraclavicular veins is used for placement of CICCs and chest-ports, access to veins of the upper limb for placement of PICCs and brachial ports, and access to femoral veins for placement of FICCs and femoral ports.[2,13,24,38,39] Interestingly, regarding external catheters, the insertion site coincides with the exit site only in non-tunneled CVADs; in tunneled CVADs, the exit site is chosen independently from the puncture site, at a location more comfortable for the patient and more appropriate to reduce the risk of infection and dislodgment.[40]

Additionally, in both children and adults, it is advisable to select a catheter with the smallest caliber and the minimal number of lumens required for treatment.[20,41] The caliber of the catheter should be no more than one-third of the inner diameter of the vein that has been punctured and cannulated; this successfully reduces the risk of catheter-related thrombosis.[42,43]

Panel's recommendations. Both external catheters (tunneled and non-tunneled CVADs like PICC, CICC, or FICC, based on the insertion site) and totally implantable devices (ports including chest, brachial, and femoral ports) should be considered for patients with cancer, with the choice depending on patient needs, treatment duration, and clinical setting.

Special considerations. The insertion site of the CVAD (supraclavicular or infraclavicular for CICCs and chest ports, upper limb for PICCs and brachial ports, lower limb for FICCs and femoral ports) should be selected based on the clinical requirements.

The exit site of a tunneled CVAD should be planned so as to achieve the best possible location in terms of reduction of bacterial contamination, patient comfort, and ease of management.

Question 3: Who should decide the type of CVAD to be inserted?

Background. The selection of the type of CVAD should involve multiple stakeholders, including the referring healthcare provider, the vascular access expert doing the procedure, the patient, and the staff involved in device maintenance.[1,3,27] Collaboration between healthcare team, patient, and caregivers is essential for the appropriate selection of the CVAD, with well-defined criteria that should be included in local hospital policies. Healthcare clinicians and vascular access experts play a crucial role, requiring knowledge and competency to select the appropriate site and device tailored to patient needs and therapy requirements. This includes understanding the patient's situation, familiarity with different devices and insertion techniques, awareness of potential complications, and device appropriateness in relation to therapy and medication.[1,3,24] Dedicated vascular access teams aid informed device placement decisions, improving compliance with infection control practices. Certified vascular access teams show higher adherence to evidence-based practices, emphasizing the importance of institutional support for specialized, multi-professional teams.[44,45] Ease of maintenance is also a key consideration, with the maintenance staff providing insights into day-to-day challenges and influencing choices toward reliable, low-maintenance options. Appropriate training of the maintenance staff is as crucial as training operators for CVAD insertion.[36,46]

The selection of an appropriate VAD should also consider the chemotherapy, immunotherapy, or antibody regimens, the patient's ability to provide self-care, patient's preferences, lifestyle, body image, any known abnormalities, and relevant medical history.[16]

Panel's recommendations. The selection of the most appropriate CVAD should be a collaborative process, involving the referring healthcare provider, the vascular access specialists, patient, the device maintenance team, and, when applicable, the patient's caregiver. The choice must be based on a comprehensive understanding of the patient's condition, the device and its insertion techniques, the awareness of potential complications, and the suitability of the device to the intended therapy and medications.

Special considerations. Institutional policies should explicitly define criteria for selecting both the insertion site and type of device, emphasizing the critical role of healthcare and vascular access professionals in decision making.

Question 4: Which factors determine the selection of a port over an external catheter?

Background. For hospitalized patients, external catheters are more appropriate. For non-hospitalized patients receiving treatment on an outpatient basis or at home, the choice is between external catheters and ports.[3,6,24] This choice should be guided by several key factors, including the anticipated duration and frequency of vascular access, patient-related factors (preference, clinical status, and patient's environment), the coagulation profile, and logistical considerations, such as the expertise of the provider and staff, the device availability, and the access to proper facilities.

Several factors may affect this choice:

Duration and frequency of the therapy: External catheters are usually preferred for medium-term treatments, while both external catheters (tunneled or non-tunneled PICCs, tunneled CICCs, and tunneled FICCs) and ports are appropriate for long-term, infrequent vascular access.[8,17]

Patient preference: Patients who swim and do not desire an external catheter for cosmetic reasons may prefer ports. The psychological benefits of ports include increased

independence, better quality of life, and minimal intrusion into personal relationships.[47,48] The choice between the type of port (chest-port vs brachial-port) may also be influenced by patient preferences.[49]

Clinical status: When considering medical devices for patients with poor functional status, the presence of existing comorbidities, such as diabetes mellitus or coagulopathy, or other concurrent conditions like sepsis or infection, may favor the selection of an external catheter over a port.[3,27,50]

Patient environment: Compared to external catheters, ports require less maintenance and have a lower infection risk if accessed infrequently. Further, ports may be the preferred option for patients residing in overcrowded areas with a lack of privacy and hygienic conditions.

Coagulation state of the patient: Owing to the invasive nature of both port implantation and access procedures, which can increase the risk of local bleeding, external catheters (and PICCs in particular) should be preferred for patients with bleeding disorders.[39] Scientific evidence indicates minimal or negligible differences between external catheters and ports in terms of the risk of symptomatic venous thrombosis. In fact, the risk of thrombosis is related chiefly to the adoption of specific strategies during VAD insertion, such as ensuring a proper catheter/vein ratio, using USG, and employing appropriate intra-procedural techniques for tip location.[42,43]

Logistics: Logistics include device availability and the presence of trained operators with adequate hospital infrastructure, as port placement involves a surgical procedure in contrast to insertion of an external catheter. Accessibility issues include distance from the facility and the need for attendants, especially for elderly, fragile, critically ill, and vulnerable patients. For patients with limited access to healthcare facilities due to distance or lack of care-giver support, ports may be preferable if the option is feasible. Barriers like financial constraints, educational gaps in the care of the device, and communication barriers also need to be addressed before selecting the CVAD.[51]

Expertise of the provider and staff: Healthcare workers involved in port care must possess adequate knowledge and skills. Despite maintenance staff proficiency, using a port for repeated procedures like blood sampling, transfusions, contrast medium injection, or parenteral nutrition with lipids increases the risk of lumen occlusion and device malfunction. In such cases, an external catheter may be a preferred alternative.[3,24,52]

Panel's recommendations. External catheters are preferred for medium-term vascular access (<3–4 months); they are also preferred for long-term (>3–4 months) frequent access (i.e. every day, every other day, or on a weekly basis). Totally implantable ports are preferred for infrequent long-term vascular access (>3–4 months duration, access every 2–3 weeks). It is advisable to select ports for patients living in environments with lower hygiene or privacy, given the easier maintenance and reduced infection risk with infrequent access. For patients with cosmetic concerns or those engaging in water activities, ports are preferred as they offer psychological advantages and less lifestyle disruption.

Special considerations. Selection of a port requires consideration of device availability, presence of trained personnel, and sufficient hospital infrastructure. For patients with limited healthcare access or caregiver support, ports are recommended when feasible.

Healthcare workers, including physicians, radiologists, nurses, and allied health professionals involved in port care throughout its lifecycle, should possess comprehensive knowledge and skills in device management.

Question 5: What are the prerequisites for the insertion of a port in terms of logistics?

Background. The panel recommends that several logistical prerequisites be met prior to the insertion of a port, including device availability, competence of the provider and staff, adequate facilities and equipment, and patient consent.

The logistical prerequisites for the insertion of a port are as follows[1–3,16,17,24]:

Device availability and access to proper facilities: Healthcare facilities must ensure availability of ports and all necessary accessories for insertion and management.

Trained clinicians: The risk of catheter-related complications is minimized if venous access procedures are performed by appropriately and specifically trained clinicians or specialized vascular access teams.

Hospital infrastructure: The healthcare facility must have a proper procedure room, all equipment and supplies required to maintain asepsis, appropriate imaging devices and monitoring equipment, as well as proper management of biomedical waste.

Patient consent and pre-procedural preparation: Any procedure should be performed with adequate consent of the patient or of the legally authorized guardian, next of kin or healthcare surrogate(s), wherever applicable. This entails explaining the procedure, risks, and benefits and obtaining the patient's agreement for port insertion. Effective communication with the patient regarding what they can anticipate before, during, and after the procedure is vital to ensure a seamless and positive experience. Other instructions, such as those related to fasting, ongoing medications on the day of the procedure, and post-procedural care requisites, should also be provided.

Adherence to organizational policies: This includes ensuring the appropriate pre-procedural preparations, aseptic precautions, hospital infection control policies, and post-procedural care.

Coordination with other departments of hospital: This involves meticulous planning starting from the dispensing of the device, consumables, and other drugs from the surgical pharmacy, receipt of all items from the pharmacy, and ensuring sterilization of the device by the operating room staff, availability of clinicians with necessary imaging equipment, and presence of a nursing staff to assist during the procedure.

Patient medical records and history: Access to the patient's medical history and records is imperative to evaluate the choice of the device and verify the appropriate indication. Adequate documentation of the procedure and post-procedural care is also crucial to maintain continuity in patient care.

Panel's recommendations. The prerequisites for the insertion of a port in terms of logistic include (a) availability of the device and access to proper facilities, including essential equipment and supplies for asepsis, imaging, and monitoring devices, and effective management of biomedical waste and (b) availability of clinicians or specialized vascular access teams with specific training in venous access procedures.

Special considerations. Informed consent must always be obtained from the patients or their legally authorized guardian, next of kin, or healthcare surrogate, as applicable, before proceeding with the procedure.

Access to the patient's medical history and records is also important to select the most appropriate device and verify its suitable application.

Accurate documentation of the procedure and subsequent care are vital to maintain continuity in patient management.

Question 6: Who should insert the port?

Background. According to all guidelines, only healthcare professionals who have received specific and appropriate training, in accordance with the regulatory standards of their healthcare system, should insert the port. These healthcare professionals may include physicians (surgeons, interventional radiologist, anesthetists, oncologist, intensivist, or any other physician duly trained), advanced practice clinicians (nurse practitioners, physician's assistants), and staff nurses.[1–3,24,27]

A team of vascular access specialists who possess extensive expertise in VAD insertion procedures, clinical care, and administration not only guarantees the highest level of patient care but also instills a sense of assurance in patients regarding their treatment and safety.[44,53,54]

Panel's recommendations. Healthcare professionals with specific and appropriate training within the regulatory framework of the relevant healthcare system should insert the port. This includes physicians (surgeons, interventional radiologists, anesthetists, oncologists, intensivists, and any other physician duly trained), advanced practice clinicians (nurse practitioners, physician assistants), and staff nurses.

Special considerations. The presence of a multiprofessional and multidisciplinary vascular access team of specifically and appropriately trained clinicians is the best strategy to ensure patient safety, clinical efficacy of the procedure, and its cost-effectiveness.

Question 7: What are the prerequisites for the insertion of an external catheter in terms of logistics?

Background. The prerequisites for the insertion of an external catheter are similar to those for a port, with the general principles remaining unchanged. Thus, the logistical prerequisites include device availability, competence of the provider and staff who are trained specifically to manage VADs, adequate facilities and appropriate equipment, patient education/consent, adherence to organizational policies, coordination with other departments in the VAD team such as the pain team, antibiotic stewardship programs, quality improvement team, besides the interdisciplinary physician/nurses collaboration, and access to the patient's medical record and/or history.[1–3,16,17,24]

Panel's recommendations. The logistical prerequisites for inserting an external catheter include device availability, provider and staff competence with specific training in VAD management, access to adequate facilities and appropriate equipment, and informed patient consent.

Special considerations. Informed consent must always be obtained from the patients or their legally authorized guardian, next of kin, or healthcare surrogate, as applicable, before proceeding with the procedure.

Access to the patient's medical history and records is also important, so to select the most appropriate device and verify its suitable application.

Accurate documentation of the procedure and subsequent care are vital to maintain continuity in patient management.

Question 8: Who should insert external catheters?

Background. USG insertion of external catheters have high success rates and minimal insertion-related complications. Insertion maneuvers should ideally be performed by multi-professional, multi-disciplinary vascular teams who have received appropriate and specific training and adhere to the institutional and regulatory standards required for this role. The panel recommends that only healthcare professionals with appropriate and specific

training within the regulatory framework of the relevant healthcare system should insert external catheters.[3,24,26,27,55] These healthcare professionals must stay updated through ongoing education and competency assessments in infusion methods and vascular access. Interdepartmental and interprofessional assessments ensure continuous expertise development and awareness of the latest advancements in these critical areas.

Panel's recommendations. Healthcare professionals with suitable and specific training within the regulatory framework of the relevant healthcare system—including physicians (such as surgeons, interventional radiologists, anesthetists, oncologists, intensivists, and other duly trained physicians), advanced practice clinicians (like nurse practitioners and physician assistants), and staff nurses should insert external catheters.

Special considerations. As in port insertion, also during insertion of an external catheter the presence of a multiprofessional and multidisciplinary vascular access team of specifically and appropriately trained clinicians is the best strategy to ensure patient safety, clinical efficacy of the procedure and its cost-effectiveness.

Question 9: Which factors determine the removal of a port after the completion of definitive therapy?

Background. The completion of definitive therapy and the risk of relapse are important considerations for port removal.[1–3] The panel considers the following factors that warrant removal of the port after completion of the definitive therapy:

Patient preference: Patients may prefer removal of a port for various reasons, including the desire to return to normalcy, financial considerations, burden of port maintenance, and fear of complications, among other reasons.[56–58]

Likelihood of early relapse: Ports can be removed following completion of the definitive therapy in patients with a lower risk of relapse. This decision is based on the assessment that the chances of requiring future vascular access for treatment are very low, indicating a positive prognosis or successful completion of the treatment.

Risk of future port-related complications: The physician and the patient should be aware of the possibility of port-related problems if the device remains in situ for an extended duration. The risk of infectious complications is significantly reduced when the port is not in use, but it is not completely eliminated as the necessary periodic flushing of the port carries the potential for contamination of the device and subsequent local or systemic infection. Port-related thrombosis typically occurs in the first 2 weeks after insertion; however, it might rarely occur after months or years. The reservoir may cause skin damage, such as in cases of weight loss. Additionally, accidental trauma to the reservoir is unlikely but possible.

Poor access to port maintenance facilities: The maintenance of ports requires periodic visits to the healthcare facility. When treatment or care extends beyond the hospital setting, patients must have access to a healthcare facility that offers specialized support for port maintenance (i.e. flushing). Thus, if a patient encounters difficulty in receiving regular maintenance, particularly when the intravenous treatment requiring the port is completed, or if other vascular access options become more appropriate or safer due to maintenance concerns, port removal is recommended.

Expected difficulty of future replacement: Before port removal, the potential need for future infusion treatments must be evaluated. Future challenges associated with a novel port insertion may arise, owing to factors such as compromised vein health, scar tissue formation, anatomical changes, technical challenges in visualizing or accessing placement sites, previous infections or complications, patient-specific factors (e.g. obesity, age, health conditions), and the experience of the operator.

Panel's recommendations. Ports must be removed after completion of the definitive therapy in cancers with a low risk of early relapse, based on minimal future vascular access needs and a favorable prognosis or treatment completion.

Special considerations. Additional considerations in favor of port removal include (a) patient preference for port removal, including desires for normalcy, maintenance burdens, and fear of complications; (b) potential risk of future device-related complications if the port is left in place; (c) impaired ability of the patient to access regular maintenance of the device; (d) availability of safer and more appropriate vascular access alternatives.

Before removing the port, the clinicians should assess the potential need for future infusion treatments and possible difficulties in future port re-insertion (e.g. due to compromised vein health, scar tissue, anatomical changes, technical challenges, previous infections or complications, and patient-specific factors).

Question 10: How frequently should a CVAD be flushed if not in use?

Background. Flushing the CVAD is important to maintain its patency and prevent device occlusion. Current evidence is inadequate to specify the optimal frequency of flushing a central line when not in use. This frequency typically depends on the type of catheter and may vary based on the local policies of each institution. Most guidelines recommend flushing ports every 4–12 weeks when not in use, while external catheters (PICC, CICC, and FICC) should

be flushed weekly. According to all current guidelines, flushing should be performed with saline only, and not with heparinized solutions.[3,24,59] Periodic flushing should be performed adopting the appropriate strategies of infection prevention (adequate hand hygiene, skin antisepsis, and sterile gloves).[3,60–62]

Panel's recommendations. Ports should be flushed at intervals ranging from 4 to 12 weeks according to specific local protocols; external catheters require weekly flushing.

Special considerations. All venous access devices should be routinely flushed using saline only.

Only venous access devices used for hemodialysis or apheresis should be routinely locked with anticoagulant solutions (heparin or <5% citrate); all other venous access devices must be routinely locked with saline only.

Limitations of the consensus

This consensus has some limitations.

First, the project was planned as an international, global consensus inviting experts from all continents. Due to limited availability of some clinicians, some important areas (such as Brazil and other countries from South America) were not represented in the final panel. Nonetheless, as far as we know, this is the first global consensus on CVAD in oncology including the point of view of European, North American, and Asian experts.

Second, the consensus did not address some specific aspects related to the technique of insertion; an updated and exhaustive discussion of these issues can be found in many international recommendations and textbooks released in the last 5 years.[2,3,13,24,26,36,38]

Further, the consensus did not address prevention and management of CVAD-related complications, which have been discussed in several high-quality consensus documents published in the last decade, with regard to infection[60,63] and venous thrombosis.[42,43]

Conclusion

CVADs have an essential role in oncology: they improve the quality of patient care, allow optimal efficacy of treatment, and enhance patients' quality of life. Nevertheless, the choice of the most appropriate device, logistics of device insertion, and the proper timing of device removal are of vital relevance. Promoting interdisciplinary cooperation, evidence-based protocols, and patient-centric care will aid healthcare teams to safely maximize the utilization of CVADs in oncology. The results of this consensus may offer healthcare professionals a global view on some critical issues concerning CVADs for cancer therapy, useful for establishing recommendations for local clinical practice.

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Author contributions

M.J and M.P performed conceptualization, data acquisition and interpretation, revising for intellectual content, writing—original draft, writing—review and editing and revising for intellectual content. C.Y.W, H.L, K.M, L.X, M.S, S.S.P, X.Z, X.Q, Y.F, performed conceptualization, revising for intellectual content, writing—review and editing.

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