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Evaluation and Management of a Patient Requiring Vascular Access

Description of the Activity	Central venous access remains a core component of the surgical care of infants and children. There are broad ranges of the clinical settings and medical conditions in which central access is required. A pediatric surgeon must be able to evaluate and manage a wide variety of healthy and critically ill patients needing venous access and demonstrate an understanding of the technical nuances of safe central line placement in patients of all sizes. A multidisciplinary, team-based approach is critical to the acute and long-term success of tunneled central catheters.
Functions	❖ Nonoperative/Preoperative ➢ Use available clinical data to confirm the need for a line, determine the type of line, and assess the urgency of the procedure. ➢ Review clinical data to identify the increased risks related to line placement (coagulopathy, thrombocytopenia, multiple previous lines, history of venous thrombosis). ➢ Obtain informed consent, describing the indications, risks, benefits, alternatives, and potential complications of the planned operation, including nuances relevant to the patient's individual condition and comorbidities, and ensure familial understanding. Document the informed consent discussion in the medical record. ➢ Devise an operative plan, and communicate it to the operative team (anesthesia, nursing, techs, assistants), including patient position, anesthesia needs, special instrumentation, and postoperative planning. ➢ Determine whether any preoperative workup is needed before line placement, such as ultrasound of vessels or an echocardiogram. ➢ Facilitate communication with the primary health care team regarding scheduling the procedure and the need for preoperative studies or transfusion. ➢ Identify additional peripheral cutdown targets (external jugular, facial, saphenous vein) for patients in whom it may be preferable to preserve larger central veins for future access or when percutaneous access may not be possible. ❖ Intraoperative ➢ Confirm that vascular ultrasound and fluoroscopy are available for the procedure when appropriate. ➢ Select the appropriate line type and size based on patient indications. ➢ Obtain percutaneous ultrasound-guided access to the internal jugular, subclavian, or femoral vein. ➢ Demonstrate knowledge of cutdown techniques for the most common cutdown sites (external jugular, facial, saphenous vein). ➢ Direct intraoperative fluoroscopy to confirm the location of the wire and identify the presence of pneumothorax. ➢ Create an appropriate subcutaneous tunnel to a location on the chest that is optimal for line access. ➢ Demonstrate a consistent technique to measure the appropriate length of the central line for the patient so that the tip is at the superior vena cava/right atrial junction. ➢ Develop a management strategy for a line that is not of appropriate length after initial placement (including lines that are either too long or too short). ➢ Identify the need to lock the line per institutional protocol. ➢ Manage intraoperative complications, including malposition of the wire, arterial stick, bleeding, and pneumothorax.

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	➢ Develop a management plan for aberrant venous anatomy that is identified intraoperatively, including the use of a contrast venogram. ➢ Identify techniques to remove tunneled lines in the operating room and at the bedside. ❖ Postoperative ➢ Provide postoperative monitoring for the patient who has undergone a vascular access procedure. ➢ Develop a management plan for postoperative complications such as pneumothorax, bleeding, venous thrombosis, catheter occlusion, and pericardial tamponade. ➢ Exchange a line if needed in the setting of a broken catheter or when a different type of catheter is needed.
Scope	❖ In scope • Diagnoses ▪ All ▪ Infected line • Procedures ▪ Hemodialysis catheter placement ▪ Tunneled central line placement with or without a subcutaneous port (with imaging guidance) • Special Populations ▪ Patients needing long-term vascular access and management ▪ Patients with limited vascular access ▪ Preterm patients (younger than a gestational age of 36 weeks) ❖ Out of scope • Diagnoses/procedures ▪ Cutdown access ▪ Peripherally inserted central catheter (PICC) placement

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1 **Framework:** The learner demonstrates understanding of information and has basic skills What a new pediatric surgery fellow should know Entrustment: The attending will show and tell or the learner acts as first assistant.	• With direct supervision, uses clinical data to determine indications for insertion, type of catheter, and urgency of the procedure in a straightforward patient • With direct supervision, identifies risk factors for line placement in an uncomplicated patient and discusses additional preop lab testing or imaging with the primary team • With direct supervision, communicates the risks and benefits of catheter placement in an uncomplicated patient to the family and obtains informed consent	• Requires direct supervision to identify targets for and perform peripheral cutdown line placement in an uncomplicated patient • With direct supervision, prepares a routine patient for catheter placement, including catheter type/size, patient positioning, anesthesia strategy, availability of vascular ultrasound and fluoroscopy/x-ray, and bundled CLABSI prevention • Demonstrates basic knowledge of how to minimize radiation risk for a patient and team members • With direct supervision, obtains percutaneous US-guided access to the internal jugular, subclavian, or femoral vein in an uncomplicated patient • Requires direct supervision during placement of a tunneled catheter including intraop fluoroscopy, identification/location of the wire, identifying pneumothorax, creating the subcutaneous tunnel, and measuring appropriate length of the tunneled catheter an uncomplicated patient • With active guidance, identifies intraop complications and aberrant venous anatomy	• Requires direct supervision to promptly identify and treat acute postop line-related complications in an uncomplicated patient • Requires direct supervision to plan and direct a postop monitoring and management plan for an uncomplicated patient who undergoes tunneled central line placement • Requires direct supervision to recognize and manage long-term complications of central venous catheters in an uncomplicated patient

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2 **Framework:** The learner demonstrates understanding of the steps of the operation but requires direction through principles and does not know the nuances of a basic case Entrustment: The learner can use the tools but may not know exactly what, where, or how to do it. The attending gives active help throughout the case to maintain forward progression or may need to take over the case at a certain point	• With indirect supervision, uses clinical data to determine indications for insertion, type of catheter,and urgency of the procedure in an uncomplicated patient (PC1 L2, PBLI1 L2, ICS2 L2) • With indirect supervision, identifies risk factors for catheter placement in an uncomplicated patient and discusses additional preop lab testing or imaging with the primary team (PC1 L2, ICS2 L2) • With indirect supervision, communicates the risks and benefits of catheter placement in an uncomplicated patient to the family and obtains informed consent (ICS1 L2)	• With indirect supervision, identifies targets for and perform peripheral cutdown line placement in an uncomplicated patient • With indirect supervision, prepares an uncomplicated patient for catheter placement, including catheter type/size, patient positioning, anesthesia strategy, availability of vascular ultrasound and fluoroscopy/x-ray, and bundled CLABSI prevention • Demonstrates understanding of and describes measures to minimize radiation risk for a patient and team members • With indirect supervision, obtains percutaneous US-guided access to the internal jugular, subclavian, or femoral vein in an uncomplicated patient • Requires indirect supervision during placement of a tunneled catheter including intraop fluoroscopy, identification/location of the wire, identifying pneumothorax, creating the subcutaneous tunnel, and measuring appropriate length of the tunneled catheter an uncomplicated patient • With direct supervision, identifies intraop complications and aberrant venous anatomy	• Requires indirect supervision to promptly identify and treat acute postop line-related complications in an uncomplicated patient • Requires indirect supervision to plan and direct a postop monitoring and management plan for an uncomplicated patient who undergoes tunneled central line placement • Requires indirect supervision to recognize and manage long-term complications of central venous catheters in an uncomplicated patient

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3 **Framework:** The learner has a good understanding of surgical options and techniques but does not recognize abnormalities and does not understand the nuances of a complicated case Entrustment: The learner can perform the operation/task independently in the uncomplicated patient or The attending provides passive/indirect supervision/suggestions in the complicated patient but still allows the learner to perform the operation/task themselves	• Independently uses clinical data to determine indications for insertion, type of catheter, and urgency of the procedure in an uncomplicated patient but requires passive assistance in the complicated patient • Independently identifies risk factors for catheter placement and discusses additional preop lab testing or imaging with the primary team in an uncomplicated patient but requires passive assistance for the medically or surgically complex patient • Independently communicates the risks and benefits of catheter placement to the family and obtains informed consent for an uncomplicated patient but requires passive assistance in a complex patient	• Independently identifies targets for peripheral cutdown catheter placement in an uncomplicated patient but requires passive assistance for the complex patient • Independently, prepares an uncomplicated patient for catheter placement, including catheter type/size, patient positioning, anesthesia strategy, availability of vascular ultrasound and fluoroscopy/x-ray, and bundled CLABSI prevention but requires passive assistance for the medically or surgically complex patient. • Coordinates efforts to minimize radiation risk for a patient and team members • Independently obtains percutaneous US-guided access to the internal jugular, subclavian, or femoral vein in an uncomplicated patient but requires passive assistance in a medically or surgically complex patient. • Independently inserts a tunneled catheter, including intraop fluoroscopy, identification/location of the wire, identifying pneumothorax, creating the subcutaneous tunnel, and measuring appropriate length of the tunneled catheter an uncomplicated patient but	• Independently identifies and promptly treats acute postop line-related complications in an uncomplicated patient but requires passive assistance in a complex patient • Independently plans and directs a postop monitoring and management plan for an uncomplicated patient who undergoes tunneled central line placement but requires passive assistance in the medically complex patient • Recognizes and manages long-term complications of central venous catheters in uncomplicated patients but requires passive assistance in the management of nuanced issues or a complex patient

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		requires passive assistance in a complex patient (e.g. multiple previous catheters). • With indirect supervision, identifies intraop complications and aberrant venous anatomy and formulates an appropriate management plan	
4 **Framework**: The learner has a strong and indepth understanding of surgical options and techniques Entrustment: Can perform the operation/task independently in complicated cases **or** The attending may need to provide indirect supervision or suggestions in the context of extremely rare or severely complicated cases	• Independently analyzes clinical data to determine indications for insertion, type of catheter, and urgency of the procedure in a challenging case, such as a neonate or child who has had multiple prior catheters or a patient with perioperative risk factors (PC1 L4, PBLI1 L4, ICS2 L4) • Independently identifies risk factors for catheter placement in a complex patient and communicates a strategy/plan including additional preop or intraop imaging or IR consultation (PC1 L4, ICS2 L4) • Independently tailors informed consent for a complex or extremely high-risk patient who requires catheter placement(ICS1 L4)	• Independently identifies targets and performs peripheral cutdown catheter placement in a complex patient • Independently prepares the OR for line placement in a complex patient, including line type/size selection, patient positioning, availability of vascular ultrasound and fluoroscopy, and bundled CLABSI prevention • Independently leads efforts to minimize radiation risk for a patient and team members • Independently obtains percutaneous image-guided access to the internal jugular, subclavian, or femoral vein in a complicated patient (neonatal, narrowed vessels, multiple prior lines) • In a patient with a difficult line placement/replacement or multiple prior lines, needs passive assistance to direct intraop fluoroscopy to identify the location of a wire and presence of pneumothorax, create the subcutaneous	• Independently diagnoses and treats acute postop line-related complications in a complex patient • Independently plans and directs a postop monitoring and management plan for a medically complex patient who undergoes tunneled central line placement • Independently recognizes and manages long-term complications of central venous catheters in all patients

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		tunnel, and measure the appropriate length of a tunneled line • Independently identifies and manages intraop complications and aberrant venous anatomy and formulates an appropriate management plan	