Purpose: **To outline the process to be followed in patients requiring vascular access according to West Michigan Regional protocols. This policy applies to EMT-Specialists and Paramedics.**

I. Indications

A. For the purpose of fluid or medication administration according to West Michigan Regional protocols.
B. External jugular cannulation should be initiated in patients in whom access is necessary and peripheral vascular access is not accessible or is contraindicated.
C. Intraosseous placement should be initiated in those patients, pediatric or adult, in whom vascular access is necessary and peripheral or external jugular vascular access is not accessible or is contraindicated.
D. Umbilical vein catheterization is indicated in newborn resuscitation.

II. Definitions

A. **Essential** - when the establishment of an IV is crucial for resuscitation or medication administration (i.e.: cardiac arrest, multi-system trauma, and internal hemorrhage).
B. **Indicated** - when the establishment of an IV is indicated at some point in patient care but is not needed for the above (i.e.: dehydration, uncomplicated chest pain, abdominal pain, and stroke).
C. **Antiseptic swab-** an antiseptic swab, for the purpose of this policy, is considered to be a swab saturated in a solution of antiseptic chemicals, determined by scientific data, to significantly reduce the colonization of microorganisms on the skin surface. (2% chlorhexidine, 70% alcohol is the recommended solution).
D. **Occlusive dressing** – an occlusive dressing is a transparent adhesive dressing specifically designed for providing a barrier to microorganisms and used to cover wounds or punctures of the skin. Acceptable products are Tegaderm, Opsite or other similar products.

III. Prophylactic IV lifelines, via Saline Lock, may be initiated in patients in whom IV access for medication administration may be necessary but IV fluid therapy unlikely.

IV. IV fluid therapy will be initiated in those situations in which fluid resuscitation may be indicated.

V. Contraindications

A. To peripheral vascular access:
   1. No peripheral sites available
   2. Burns overlying available peripheral sites unless no other sites available
   3. Infection overlying available peripheral sites
B. To intraosseous infusion:
   1. If infiltration occurs (rare), do not reuse the same bone, as fluid will leak out of the original hole, select another site.
   2. Do not place in a fractured extremity. If the femur is fractured, use the opposite leg.
C. To umbilical vein catheterization:
   1. Inability to identify the umbilical vein or place the catheter

VI. Special Considerations (Side effects/Complications)

A. Initiation of vascular access generally should not delay patient transport to the hospital.
B. General side effects or complications: infection, air embolism, catheter shear, hematoma, arterial puncture, and fluid overload
C. External jugular cannulation:
   1. Air embolism is a significant risk; occlude catheter hub with gloved finger while preparing to attach IV tubing.
D. Intraosseous placement:

1. Complications include subperiosteal infusion, osteomyelitis, sepsis, fat embolism, bone marrow damage.

VII. Medication Administration

A. All blood and/or crystalloid solutions may be administered through the vascular sites listed in this policy.

B. The following drugs may be administered via these vascular sites:

- adenosine	- atropine
- amiodarone	- bicarbonate
- calcium chloride	- dextrose 50%, 25%, 20%, 10%
- diazepam	- diphenhydramine
- dopamine	- epinephrine
- furosemide	- glucagon
- lidocaine	- midazolam
- magnesium sulfate	- morphine
- naloxone	- thiamine
- vasopressin	

VIII. Standards for IV attempts

A. Essential IV: attempts performed as necessary, consider IO
B. Indicated IV: two attempts per medic
C. Document any reasons for deviation.

IX. Venipuncture sites

A. **Essential IV's** - any peripheral site (including external jugular) where large bore (18 ga or larger) can be started.
B. **Indicated IV's** - peripheral site distal of the knee or elbow is preferred.
C. **Central lines** - under NO circumstances should central lines (e.g. subclavian vein, internal jugular vein, and femoral vein) be placed.

X. Needle size for IV placement

A. Adult TKO 18 ga - 20 ga Angiocath
B. Adult trauma/internal bleeding/C-arrest 14 ga - 16 ga
C. Child 20 ga - 24 ga Angiocath

XI. Flow Rates

A. Flow rates for all IV's are to be at rates TKO unless otherwise indicated by specific protocol or Medical Control.
   1. 25 ml/hr should be administered "to keep vein open" in adult or child patients. (25 micro gtts per min. or 4-5 macro gtts per min)
   2. The use of saline locks is encouraged in place of prophylactic TKO IV lines.
B. The amount of fluid infused along with the IV rate is to be noted on the EMS Medical Record.
C. Any reason for variation from standard flow rates must be documented on the EMS Medical Record.
D. The standard fluid bolus volume will be 300 ml with repeat as necessary, unless otherwise noted by protocol, titrating until signs of adequate perfusion are present. The bolus would be contraindicated in patients with pulmonary edema. Volume for pediatric patient will be the same, unless otherwise noted by protocol.
E. Medicated drips should be piggybacked to main IV line or saline lock.

XII. Solutions - Protocol or Medical Control dictates choice of solution

A. D_5W
   1. As the base solution of dilution for IV drip medications (e.g.: lidocaine, dopamine)
B. Normal Saline 0.9%
   1. May be used to keep vein open

2. Used to flush medications
3. Used for volume infusion
   a. For rapid infusion, use blood tubing
4. Used for fluid hydration

XIII. IV Tubing

A. Normal Saline - macrodrip; consider blood tubing in trauma patients.
B. Medication Drips in D_5W - microdrip tubing
C. Children - microdrip
   1. If fluid bolus may be needed, attach extension tubing and stopcock to IV line.

VIV. Procedures

A. Utilize universal precautions

B. Procedure for Peripheral Vascular Cannulation:

1. Gather and prepare equipment
   a. IV catheter
   b. Antiseptic swab
   c. 6 cc - 12 cc syringe
   d. 4x4, Tegaderm and tape
   e. Normal saline lock cap and solution, if applicable - draw up 10ml of normal saline into the syringe
2. Position patient
3. Place the tourniquet on the extremity
4. Cleanse the skin with antiseptic swab (cleanse entire area that will be covered by the occlusive dressing)
5. Make your puncture while maintaining vein stability
6. Watch for flashback. If you have no blood return and you are in the vein, remove the needle hub and attach your syringe to assist in aspirating for blood. Once you have a blood return, advance the catheter as per normal IV technique and attach the IV tubing or normal saline lock cap.
7. Instill 2-3 ml of normal saline if normal saline lock placed
8. Apply an occlusive dressing over the IV site
9. Tape may be used to further secure catheter and IV tubing (remember not to restrict other vascular structures by applying dressing too tight)

C. Procedure for External Jugular Cannulation:

1. Gather and prepare equipment
   a. IV catheter
   b. Antiseptic swab
   c. 6 cc - 12 cc syringe
   d. 4x4, occlusive dressing and tape
   e. Normal saline, lock, cap and solution, if applicable - draw up 10-12 ml of normal saline into the syringe
2. Position patient supine (trendelenburg, if possible)
3. Turn head to opposite side of venipuncture (if no C-spine injury is suspected)
4. Cleanse the skin with antiseptic swab (entire area to be covered by occlusive dressing)
5. Tourniquet the vein by using the side of your finger above the clavicle to facilitate filling the vein.
6. Make your puncture midway between the angle of the jaw and the middle of the clavicle while maintaining vein stability with your finger as the tourniquet effect.
7. Watch for flashback. If you have no blood return and you are in the vein, remove the needle hub and attach your syringe to assist in aspirating for blood. Once you have a blood return, advance the catheter as per normal IV technique and attach the IV solution or normal saline lock cap, covering catheter with gloved finger while preparing to attach the IV tubing.

8. Instill 2-3 ml of normal saline if normal saline lock placed.
9. Secure IV catheter and tubing with occlusive dressing and tape, if necessary.

D. **Procedure for Intraosseous Placement:**

1. If peripheral or external jugular veins are readily attainable, catheterization via those sites should be immediately attempted. If no peripheral or external jugular IV sites are readily attainable, it is acceptable to immediately proceed with intraosseous infusion.
2. Placement of the IO line by the following technique:
    a. Have all IO equipment ready prior to bone penetration
    b. Expose the lower extremity
    c. Stabilize the lower extremity to minimize motion
    d. Selection of site
        1) In children less than five years of age, the preferred order of insertion sites is proximal tibia, distal femur, and medial malleolus.
        2) In adults or children greater than five years of age the only recommended site will be the medial malleolus.
    e. Scrub the insertion site with antiseptic swab. Strict adherence to aseptic technique is essential.
    f. Insert the IO needle
        1) **Proximal Tibial Technique:** Place sand bags or rolled towels under the knee. Insert the needle, one finger's breadth below the tibial tuberosity and slightly medial to midline, perpendicular to the skin directed away from the epiphyseal plate, and advance to the periosteum. The bone is penetrated with a slow boring or twisting motion until you feel a sudden "give"(Decrease in resistance) as the needle enters the marrow cavity

        2) **Medial Malleolus Technique:** Insert the needle, midline 1 to 2 cm's above bony prominence of medial malleolus, perpendicular to the skin, directed away from the epiphyseal plate. Advance to the periosteum. The bone is penetrated with a slow boring or twisting motion until you feel a sudden "give" (decrease in resistance) as the needle enters the bone marrow.

        3) **Distal Femur Technique:** Place sandbags or rolled towels under the knee. Stabilize the proximal thigh. Insert the needle, 2-3 fingerbreadths above the femoral condyles in the midline, perpendicular to the skin directed away from the epiphyseal plate. Advance to the periosteum. The bone is penetrated with a slow boring or twisting motion until you feel a sudden "give"(decrease in resistance) as the needle enters the marrow cavity.

    g. Attempt to confirm marrow placement by removing the stylet and aspirating blood and/or bone marrow.
        1) If unable to aspirate, attach 12ml syringe with normal saline and gently infuse normal saline.
        2) Observe for normal saline leakage or SQ tissue swelling
            a) If neither occurs, proceed
            b) If either occurs, select a different site

h. Connect the appropriate IV equipment (normal saline locks not indicated in IO placement)
i. Administer the appropriate fluids and/or drugs
j. Stabilize the entire intraosseous set-up as if to secure an impaled object
k. Notify Medical Control of the IO placement

3. If the IO is unsuccessful after 2 attempts, contact Medical Control.

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