A 3-year-old girl is brought to the emergency department with lethargy and fever. She had diarrhea for several days, and her parents say that "she suddenly took a turn for the worse". The girl has refused liquids for the past 12 hours and has not urinated today. She has no allergies and takes no medications. Her temperature is 39.7 C (103.5 F), blood pressure is 60/28 mm Hg, and pulse is 145/min. On examination, she is lethargic and has poor skin turgor. Her capillary refill time is 5 seconds centrally. Despite numerous attempts, it is not possible to start a peripheral intravenous line, and the child's condition continues to deteriorate. Which of the following is the best next step in management of this patient?

- A. Attempt arterial line placement
- B. Attempt central venous catheter placement
- C. Attempt intraosseous cannulation
- D. Attempt nasogastric tube placement
- E. Attempt peripheral intravenous line placement
- F. Transport to intensive care unit for central venous catheter placement

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- A. Attempt arterial line placement [1%]
- B. Attempt central venous catheter placement [11%]
- ✔ C. Attempt intraosseous cannulation [74%]
- D. Attempt nasogastric tube placement [1%]
- E. Attempt peripheral intravenous line placement [1%]
- F. Transport to intensive care unit for central venous catheter placement [12%]

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Explanation: **User Id:** [redacted]

This child's presentation is concerning for hypovolemic or septic **shock** and requires emergency **fluid resuscitation**. When intravenous access cannot be obtained in emergency cases, **intraosseous (IO)** access should be attempted immediately. IO access requires less skill and practice than central line placement, and clinical trials have demonstrated IO lines to be safer and faster than central lines. IO catheters provide a cannula large enough to deliver fluids and medications rapidly and to obtain blood samples for laboratory testing.

The most common site for IO access is the **proximal tibia** due to its wide, flat surface and distance from the sternum in case cardiopulmonary resuscitation is performed simultaneously. However, any large bone can be used. IO catheters can be placed manually or with a driver. Contraindications to IO placement include infection (eg, cellulitis) overlying the access site, fracture or previous IO attempts in the chosen extremity, or bone fragility (eg, osteogenesis imperfecta).

(Choice A) Arterial lines are used for continuous blood pressure monitoring and to draw laboratory studies. They are not used for fluid resuscitation and should be placed after

samples for laboratory testing.

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(Choice A) Arterial lines are used for continuous blood pressure monitoring and to draw laboratory studies. They are not used for fluid resuscitation and should be placed after the patient has been resuscitated as the procedure takes time and great skill.

(Choices B and F) Central catheters take longer to place than IO lines and require a higher amount of procedural skill and practice. This child needs immediate access for fluid resuscitation, and transporting her within the hospital will cause delays. A central line can be placed later if necessary when the patient is stable.

(Choice D) Although nasogastric fluids are preferred for mild to moderate dehydration associated with gastrointestinal disease, they are not recommended in shock, when the splanchnic circulation is constricted. At this point, absorption of enteral fluids will not be rapid enough to correct the patient's hypovolemia.

(Choice E) Several attempts at peripheral intravenous insertion have already failed. Given that the child is in uncompensated shock, access should be escalated to IO placement.

Educational objective:
Intraosseous lines can be placed rapidly when emergency access is necessary and peripheral access cannot be obtained. Intraosseous access can be performed with less required skill and practice than central venous access.

References:

1. Comparison of umbilical venous and intraosseous access during simulated neonatal resuscitation.
2. Comparison of intraosseous versus central venous access in adults under resuscitation in the emergency department with inaccessible peripheral veins
3. Intraosseous versus intravenous vascular access during out-of-hospital cardiac arrest: a randomized controlled trial.

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