RESUS4KIDS

Intraosseous Access

Instructors Manual

2018

Contents

Contents

Contents 2
Authors 3
Acknowledgement 3
Disclaimer 3
About this module 4
Pre requisites 4
Requirements and resources for running the IO insertion practical course 5
Equipment Required 6
Table set up for ‘Round the Table’ Teaching 7
Recording Participant attendance and certificates 8
RESUS4KIDS IO Insertion Practical Course – Lesson Plan 8
Scenario: Intraosseous access 10

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Disclaimer

About this module

This practical module is designed to provide healthcare workers with the knowledge and skills required to obtain intraosseous access. It is an optional module and is not compulsory in order to gain successful completion of RESUS4KIDS Short Practical Course. It is up to the individual facilities to decide which participants attend this practical session.

This module can be taught in addition to the 90 minute RESUS4KIDS Short practical course taking the total course time to approximately 2 hours or during a separate teaching session.

This course is taught in the same format as the RESUS4KIDS Short Practical Course and maintains the same instructor to participant ratio of 1:6

Pre requisites

The pre requisite for this module is the Intraosseous Access e-Learning module available on the RESUS4KIDS e-Learning portals in My Health Learning (HETI NSW Health Employees) or www.resus4kids.com.au (non NSW Health Emplyees). Participants must successfully complete the e-Learning post-test prior to attending the face to face session.

Requirements and resources for running the IO insertion practical course

- Instructors are responsible for ensuring that all participants meet the course participant prerequisites
- Instructors must follow the course format, unless prior approval has been obtained from the RESUS4KIDS executive.
- The instructor to student ratio must not exceed 1:6, unless prior approval has been obtained from the RESUS4KIDS executive. Participant numbers may be less than 6 at the instructor's discretion.
- Instructors who wish to teach the RESUS4KIDS Intraosseous Practical Course must be current RESUS4KIDS instructors.
- Resources for setting up, running, evaluating and reporting courses are available at www.resus4kids.com.au under 'instructor resources'.
- Registered instructors will be emailed the password to access the secure page when they complete the RESUS4KIDS train the trainer course. Please note that the password will change periodically and the instructors will be notified of this change by email.

Equipment Required

Room (The room needs to be large enough for all participants and instructor with a table placed in the middle)

Infant Manikin (1 per instructor) – suggested manikin ALS as this manikin has a specifically designed IO access leg or part task trainer

Extra leg blood tubes for infant manikin

Practise bones if a manikin that can have IO inserted is unavailable.

EZ IO Drill

EZIO training needle

Picture of the 3 different EZIO needles (located on the last page of this booklet)

Manual IO needles

Alcohol wipe

10ml syringe x2

3ml syringe x1

IO extension set

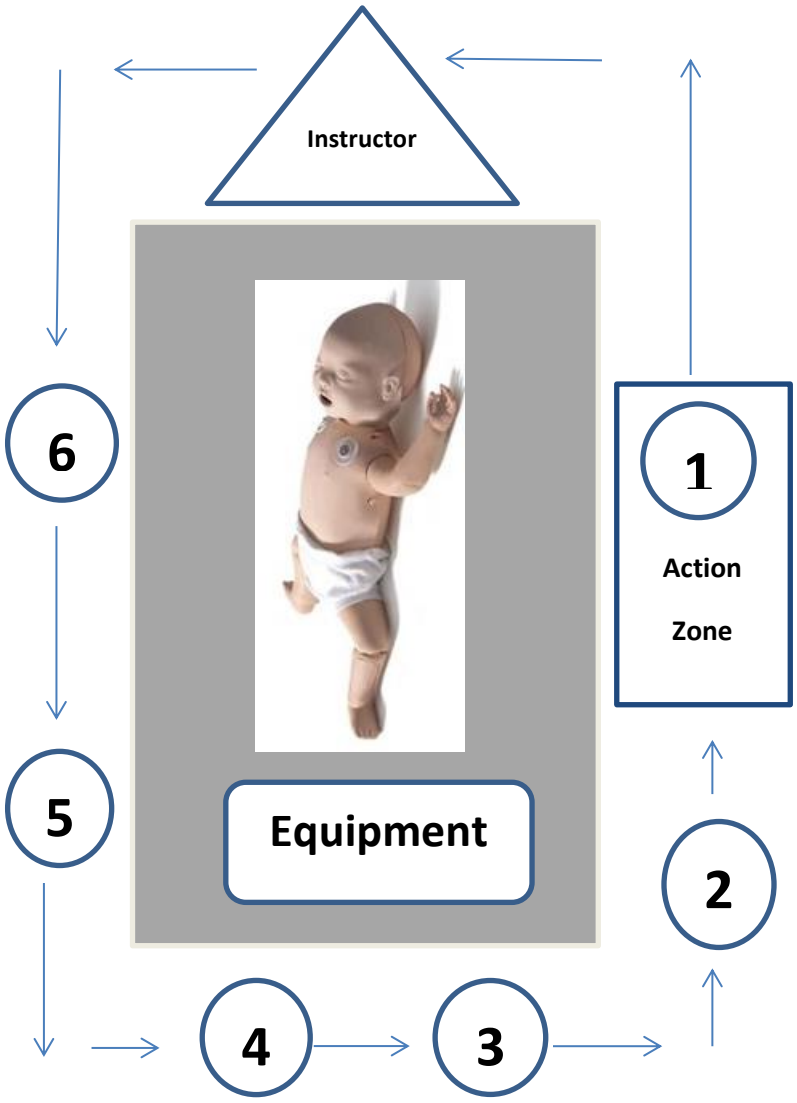
EZIO Stabiliser

Option:

If you don't have access to an IO manikin or part task trainer you can alternatively use a crunchie bar wrapped in brown tape

Table set up for ‘Round the Table’ Teaching

This course is taught using ‘Round the Table Teaching’ methodology which is used in the first scenario of the RESUS4KIDS short practical course. It is an effective way to teach this course as every member of the group has an opportunity to demonstrate a different component of an IO insertion, which makes the process less threatening and means that every member of the group has a turn of participating. Set the table or bed up as shown below. The numbered circles represent where the 6 participants stand.



Steps performed by the different participants

Participant 1: Indication for insertion and insertion sites

Participant 2: Preparation for insertion – choosing the correct size IO needle

Participant 3: Insert an IO needle using the EZ IO drill

Participant 4: Secure an IO using an EZ-Stabilizer

Participant 5: Removing an IO

Participant 6: Manual IO insertion

All participants will have the opportunity to insert an IO using the EZ IO Drill and using a manual IO needle.

1. Participant 1 identifies the different clinical indications for obtaining IO access. Once they have done this and the instructor is happy to move on participant 1 moves around the table to where participant 6 was standing and all group members move up a place. This now places participant 2 in the ‘action zone’ to identify insertion sites.
2. Once participant 2 has identified the correct IO needle they move around the table and participant 3 is now in the ‘action zone’.
3. Once participant 3 has inserted an IO using an EZ IO Drill each member of the group now has the opportunity to insert an IO using an EZ IO drill. When each member has demonstrated this skill participant 4 is now in the ‘action zone’ to demonstrate how to secure an IO needle.
4. Participant 5 demonstrates how to remove an IO needle.
5. Participant 6 demonstrates how to insert a manual IO. Each participant is then to have a turn demonstrating a manual insert of an IO needle.

Recording Participant attendance and certificates

Please record participant's attendance at this practical session on the RESUS4KIDS Classroom Recording System. When entering the class details please select 'IO practical session'.

Once a class has been authorised participants will be issued with an email which will provide them with a link to a 90 second survey. Once participants have completed this survey they will then be able to access their certificate of attendance.

RESUS4KIDS IO Insertion Practical Course – Lesson Plan

Topic	RESUS4KIDS Intraosseous Insertion Practical Course	
Instructors	Instructors who have undertaken the RESUS4KIDS Train the Trainer course	
Participants	Healthcare workers caring for acutely unwell children **Maximum 6 participants per instructor**	
Timeframe	40 minutes	
Training objectivise	By the end of the 40 minute practical course participants will be able to: • Describe the common clinical indications for obtaining intraosseous access • Identify the 4 potential landmarks with 8 target sites for intraosseous access • Describe contradictions for intraosseous access • Insert both an EZ IO and manual intraosseous needle • Safely secure an intraosseous needle • Describe important considerations for fluid and medication administration via intraosseous access.	
Prerequisites	All participants who attend the IO insertion practical session are expected to have completed the RESUS4KIDS Intraosseous Access e-Learning module prior to attending this session. This requires that they have completed the post course test with a pass mark of 4 out of 5. When this is achieved the participant will be able to print a certificate. Instructors must sight this certificate at the start of the practical session.	
Preparation	1. Assemble all equipment and ensure that it is in working order 2. Arrange equipment and manikins on the tables.	
Welcome and Introduction	State the learning objectivise Toilets and fire exits Mobiles onto silent, pagers on vibrate	

Scenario based teaching	Pause and discuss format, scenario based teaching	
Introduction to the scenario	Instructor will: • Discuss that this is a pause-and-discuss format so it will not necessarily go in real time as we will stop at appropriate intervals to discuss things. • GREY SHADED AREAS IN THE LESSON PLAN ARE TO BE PAUSED AND A DISCUSSED WITH THE GROUP THE WHITE AREAS CONTAIN AN ACTION STEP FOR EITHER ONE OR ALL PARTICIPANTS TO COMPLETE • Remind participants that this is a chance to consolidate what they have learnt in their e-learning, it is not new information	
Suggested technique for small group skill practice	Round the table teaching method which is described in detail above in this manual.	
Note for instructors	It is important that, by the end of the session at least, every participant has met the learning objectives	

Scenario: Intraosseous access

Emergency Department

You are working as part of your emergency team caring for Sarah a one year old girl (10kg) who has a 3 day history of vomiting and diarrhoea. Her mother brought her to the emergency department as she has not been able to tolerate anything orally for 3 days. On arrival in the department she became unresponsive and not breathing normally. Life support is in progress and you have been asked to obtain intravenous access. You have 2 failed attempts at obtaining intravenous access.

Or

Ward setting

You are caring for Sarah a one year old girl (10kg) who was admitted to the ward with a three day history of vomiting and diarrhoea. While on the ward she became unresponsive and not breathing normally. Life support is in progress and you have been asked to obtain intravenous access. You have 2 failed attempts at obtaining intravenous access.

Or

Pre Hospital

You are called to attend a one year old girl, Sarah (10kg). Her mother called an ambulance as she has had a 3 day history of vomiting and diarrhoea and is not able to tolerate anything orally. When you arrive at her house she is unresponsive and not breathing normally. Life support is in progress and you have been asked to obtain intravenous access. You have 2 failed attempts at obtaining intravenous access.

IO Insertion Steps	Expected steps by participants	Instructors Prompt	Time
Participant 1 **Action Step** **Indication for insertion and insertion sites**	Participant to identify the potential clinical indication for inserting an IO. Identify the 4 potential insertion sites with 8 target points for obtaining IO access.	• Peripheral IV access cannot be gained with 60 seconds or x2 failed attempts within 60 seconds in an arrest situation • **Immediate** need to infuse fluids or medications in a conscious -alert patient or in an unconscious patient where you are unable to gain intravenous access. • Proximal Humerus • Distal Femur • Proximal Tibia • Distal Tibia **Proximal Humerus:** The humerus is most easily palpated at the insertion point for the deltoid muscle, between the biceps and triceps muscles. This point is approximately mid-way along the length of the arm. Palpation of the bone requires firm pressure due to overlying structure. The greater tubercle of the proximal humerus is located approximately 2cm below the acromion process. For optimal insertion, rotate the arm inward and place patient's hand on abdomen (over the umbilicus). Palpate the greater tubercle of the proximal humerus, just above the surgical neck. The greater tubercle is the insertion site. Insert needle set into greater tubercle, using a slight downward angle. The proximal humerus should only be used in paediatric patients when landmarks can be clearly identified.	2 min

		Distal Femur: The femur is a triangular bone with the point of the triangle on its anterior aspect. The insertion site is located just proximal to the superior border of the patella (maximum 1cm) and approximately 1cm medial to midline. **Proximal Tibia:** Preferred insertion site in children as it has a broad flat surface with a thin layer of skin covering the bone. Palpate the tibial tuberosity and the medial border of the tibia. The insertion site is approximately 1cm medial to the tibial tuberosity, or just below the patella (approximately 1cm) and slightly medial (approximately 1cm), along the flat aspect of the tibia. **Distal Tibia:** Insertion site is located approximately 1-2cm proximal to the most prominent aspect of the medial malleolus. Palpate the anterior and posterior borders of the tibia to assure that your insertion site is on the flat center aspect of the bone.	
Participant 1 **Discussion** **Indication for insertion and insertion sites**	**Questions to ask the participants** Can 2 or more IO catheters be placed in the same extremity? What is the preferred IO insertion site in children?	No. If multiple attempts are made in the same extremity, repeated penetration of the bony cortex may result in extravasation, which may lead to more serious complications. **The Proximal Tibia** is the most common site used for IO insertion in children however the preferred insertion site in children is the site that the person inserting is able to easily identify that contains no contraindications.	2 min

	What are the contraindications for IO insertion? **Further information that can be used if the discussion points arise** Can the EZ-IO be used in the sternum?	• Fracture or suspected fracture of the target bone. • Local infection • Inability to locate the landmarks • Scar indicative of prior joint surgery • Previous IO or attempt in the limb within the last 48 hours Note: If an IO is inserted into a fractured bone the fluid will leak out of the fracture into the surrounding tissue and the risk of compartment syndrome increases significantly The EZ-IO Sternal Intraosseous System is designed and intended for use by the military only. The EZ-IO needle set should NEVER be used for sternal insertion as it is not designed for this insertion site as per the manufacture.	

Participant 2 **Action Step** **Preparation for insertion**	Participant to select the appropriate EZ-IO needle from the pictures provided Participant to demonstrate how to prepare the insertion site	There are 3 EZ-IO needle to choose between **Pink**: 15mm needle suitable for children that weigh between 3-39kg **Blue**: 25mm needle. Should be considered for children > 40kg or for insertion sites that have a large amount of fatty tissue covering the site. **Yellow:** 45mm needle. Should be considered for the proximal humerus for patients greater than 40kg. Alternatively on patients with excessive tissue over insertion site. Use an alcohol wipe or suitable accredited skin cleaning solution to clean the skin	1 min

Participant 2 **Discussion step** **Preparation for insertion**	**Questions to ask the participants** How do you size an IO needle? How does the EZ-IO needle attach to the EZ-IO drill Participant to discuss appropriate PPE required **Further information that can be used if the discussion points arise** How long does the battery on the EZ- IO drill last for	To ensure the correct size of an IO needle has been selected there should be at least one black line above the skin once the needle has been inserted into the soft tissue. If no black lines can be seen on the needle it is too short and a longer needle is required. **Note**: IO needle selection is also dependent on site and tissue thickness above the bone. It is not always determined by weight. The needles attach to the drill magnetically so once attached correctly will not fall off. PPE: Gloves and goggles The battery life on the drill lasts for between 500-700 uses. On the back on the EZ-IO drill there is a green light. When this light changes to red it means that the drill has less than 10% battery life left.	1 min
Participant 3 **Action Step** **Insertion using EZ IO Drill**	Participant to demonstrate how to insert an IO needle using the EZ-IO drill	1. Insert needle without drilling through the soft tissue at a 90 degree angle to the bone 2. Before drilling, verify you can see **one of the black lines** on the needle above the surface of the skin. If you are unable to see at least one	3 min

		black line on the needle above the skin the needle is too short and an alternate needle should be chosen. 3. With a gentle grip, press the trigger continuously. Apply the minimal amount of pressure required to keep the driver advancing straight into the bone. 4. When you feel a decrease in resistance this indicates that the needle set has entered the medullary space, take your finger off the trigger. 5. Remove the driver by stabilizing the hub with one hand and pulling straight back with the driver. 6. While continuing to hold the needle hub, twist the stylet out of the needle by rotating the stylet counter-clockwise. 7. Confirm placement by aspirating marrow and send sample to lab clearly marked as BONE MARROW **Note**: On aspiration you are not always able to aspirate bone marrow. If you are unable to aspirate marrow this does NOT mean that you are in the incorrect place. If unable to aspirate marrow secure the IO and attempt to flush. **NOTE:** There is often resistance felt at the start of the 2-5mL flush. This occurs as the thick fibrin mesh inside of the bone is opening up. In some cases a second 2-5mL flush is required to completely open the area.	
Participant 3 **Discussion step** **EZ IO Drill Insertion**	**Questions to ask the participants** How deep should the needle set be inserted when powering the EZ-IO into the bone?	Push needle set tip through the skin until tip rests against the bone. The 5 mm mark from the hub must be visible above the skin for	2 min

		confirmation of adequate needle set length. Squeeze driver trigger and apply moderate, steady pressure. Technique/Training Immediately release the trigger when you feel the “pop” or “give” as the needle set enters the medullary space.	
	If you are unable to aspirate marrow does this mean you are not in the correct place?	If you are unable to aspirate marrow the needle may still be in the correct place. **Do not** discard the needle based on the inability to aspirate marrow alone.	
	Further information that can be used if the discussion points arise What tests can be done using the bone marrow?	Bone marrow can sometime be used for a number of blood tests. In a study by Vidacare IO blood proved most reliable for: - blood cultures - full blood count - glucose - blood urea nitrogen - creatine - chloride - total protein - albumin There are also a number of other blood tests that IO blood can be used for however results may not be as accurate as normal blood tests. Bone marrow **cannot** be used on a blood gas machine. Note: Not all sites have the facilities to test bone marrow so when teaching this make sure that your individual facility has this capability before educating staff about sending bone marrow to the laboratory. It is also important when sending a bone marrow sample to pathology to clearly label the sample as **BONE MARROW**	

	What are the potential complications when inserting an IO? Pain management	• Going straight through the bone. If this occurs a new site of insertion must be chosen as the bone will now leak any fluid inserted into the tissue space. • Compartment syndrome: can result if a large extravasation goes undetected. • Osteomyelitis: is a rare but serious infection. Vidacare records indicate less than 1:100,000 insertions. IO Infusions may occasionally be required in conscious patients. In this circumstance the patients may experience some discomfort from the pressure in the medullary compartment. In some cases patients may benefit from the use of IO preservative free lignocaine given before the 0.9% sodium chloride flush. You should refer to local institutional guidelines and protocols for more information.	
All participants **Action Step**	All participants to now have a turn inserting an IO needle using the EZ-IO Drill	All participants to demonstrate steps 1 to 7 in 'Insertion using EZ-IO Drill' 1. Insert needle through the soft tissue at a 90 degree angle to the bone 2. Before drilling, verify you can see **one of the black lines** on the needle above the surface of the skin. If you are unable to see at least one black line on the needle above the skin the needle is too short and an alternate needle should be chosen. 3. With a gentle grip, press the trigger continuously. Apply the minimal amount of pressure required to keep the driver advancing straight into the bone.	10 mins

		4. When you feel a decreased in resistance this indicates that the needle set has entered the medullary space, take your finger off the trigger. 5. Remove the driver by stabilizing the hub with one hand and pulling straight back with the driver. 6. While continuing to hold the needle hub, twist the stylet out of the needle by rotating the stylet counter-clockwise. 7. Confirm placement by aspirating marrow and send sample to lab clearly marked as **BONE MARROW**	
Participant 4 **Action Step** **Securing the IO**	Participant to demonstrate how to secure an IO needle	An EZ-Stabiliser should be used to secure the needle and prevent accidental dislodgement. To use the EZ-Stabiliser 1. Remove the stylet 2. Centrally locate the catheter to the eye of the stabilizer and place the stabilizer on the catheter 3. Attach the EZ-Connect to the stabilizer 4. Remove the stabilizer's adhesive backing. Hold the stabilizer and gently pull tab 1 followed by tab 2. 5. Flush with 2-5mLs of 0.9% sodium chloride	2 min
Participant 4 **Discussion step** **Securing the IO**	**Questions to ask the participants** What do you need to observe the IO site for? Pink wrist band	IO sites require the same observations as an IV cannula • Swelling • Bleeding • Leaking from site Once an IO has been inserted or an attempt at an IO has been made it is important that a pink wrist band is	1 min

		placed on the limb where the IO has been or attempted to be inserted and remain there for 48 hours as a visual reminder not to insert another IO in that limb.	
	Further information that can be used if the discussion points arise Will the IO catheter clot off if unused for a few hours?	Possibly. IO access may be compromised if the line is not used for prolonged periods. IO lines can often be opened successfully by an additional flush.	
All Participants **Fluid and medication Administration** **Discussion step**	**Important consideration for IV fluids and medication administration:** The pressure in the medullary space is approximately 1/4 of the patient's mean arterial pressure. This is important to note as the pressure outside of the bone in the IV bag must be higher than the pressure inside the bone to achieve flow. This means that fluids and medications must be delivered under pressure in order to obtain maximum flow rate. This can be achieved by administering fluids or medications under pressure via a syringe or an infusion pump. Normal fluid volumes and medication doses based on weight should be followed when administering fluids and medications via an IO. **What medications and fluids can be administered via IO?** All medications and fluids that can be given intravenously can be administered via an IO. Incompatible drugs and fluids should be infused sequentially in a manner consistent with standard IV infusion practice. **How quickly do the fluids and medication reach the central circulation system?** Fluids and medication gain access to the central circulation within a few seconds of administration via an IO.		
Participant 5 **Action step** **Removing the IO**	Remove the IO	To remove the EZ-IO needle 1. Remove the EZ-Connect 2. Loosen the adhesive dressing securing the IO	2 min

		3. Attach any Luer-lock syringe 4. Remove the final part of the EZ stabiliser 5. Stabilize patient's extremity 6. Rotate syringe and catheter clockwise while pulling straight out to withdraw catheter. **Do not rock or bend the catheter during removal.** When catheter has been removed, immediately place in appropriate biohazard container	
Participant 5 **Discussion step** **Removing the IO**	**Questions to ask the participants** How long can an IO stay in place? **Further information that can be used if the discussion points arise** Does the insertion site bleed when an IO has been removed?	IO needles need to be changed every 24 hours. Once an IO has been removed there is often minimal bleeding, this potentially will be influenced by the patient's condition. Clean the site and cover with an appropriate dressing	1 min
Participant 6 **Action Step** **Manual Insertion of an IO**	Participant to demonstrate how to manually insert an IO needle	1. Prepare the intended insertion site with an antiseptic wipe 2. Hold the manual IO needle with the handle in the palm of your hand and grasp the needle with the thumb, index and middle fingers. Holding the needle distally will help stabilise it during insertion. 3. Insert needle through the soft tissue at a 90 degrees to the skin using a twisting motion 4. Continue to insert until a 'give' is felt – this indicates that the needle has entered	2 min

		the bone cortex. 5. Remove the inner cannula 6. The needle should now stand on its own. 7. Confirm placement by aspirating marrow and send sample to lab clearly marked as **BONE MARROW** **Note**: On aspiration you are not always able to aspirate bone marrow. If you are unable to aspirate marrow this does NOT mean that you are in the incorrect place. If unable to aspirate marrow move on to step 8 8. Attach extension tubing and flush with 2-5mLs of 0.9% Sodium Chloride.	
Participant 6 **Discussion Step** **Manual Insertion of an IO**	**Questions to ask the participants** How do you measure a manual IO?	There are 2 different manual IO needles to choose from 16g and 18g.The depth of the insertion is operator dependent.	1 min
All Participants **Action Step**	All participants to now have a turn manually inserting an IO needle.	All participants are to now demonstrate steps 1 to 8 above. 1. Prepare the intended insertion site with an antiseptic wipe 2. Hold the manual IO needle with the handle in the palm of your hand and grasp the needle with the thumb, index and middle fingers. Holding the needle distally will help stabilise it during insertion. 3. Insert needle through the soft tissue at a 90 degrees to the skin using a twisting motion 4. Continue to insert until a 'give' is felt – this indicates that the needle has entered the bone cortex. 5. Remove the inner cannula 6. The needle should now stand on its own. 7. Confirm placement by	10 mins

		aspirating marrow and send sample to lab clearly marked as **BONE MARROW** 8. Attach extension tubing and flush with 2-5mLs of 0.9% Sodium Chloride.	
Instructor wrap up	Instructor to answer any final questions from participants and bring the session to an end		1 min

EZ-IO Needles