

Low-Cost Fishhook Removal Simulation

David Mitchell Baskin, MS* and Christopher Ashby Davis, MD*

*Wake Forest University School of Medicine, Department of Emergency Medicine, Winston-Salem, NC

Correspondence should be addressed to David Mitchel Baskin, MS at dbaskin@wakehealth.edu

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ABSTRACT:

Audience: The target audiences for this hands-on innovation are health care providers including medical students and emergency medicine residents. This simulation is also appropriate for small group sessions teaching the layperson.

Background: While generally not life-threatening fishhook injuries are commonplace. They can end a day of recreation or an outdoor trip and possibly result in a visit to an emergency department or urgent care. Hands-on education on fishhook removal techniques that minimize tissue damage is rarely provided in wilderness first aid or traditional medical education. To the best of our knowledge, to date there are only two studies on fishhook removal simulations in medical and wilderness first aid education.^{1,2} The previously described simulation models are limited by accessibility of materials, realism, and cost.

Educational Objectives: The goal of this small group session is to fill the gap in training on fishhook injuries. At the end of the session participants should be able to describe the parts of a fishhook, as well as demonstrate and have increased confidence in performing multiple fishhook removal techniques.

Educational Methods: Social learning theory is the conceptual framework for this small group session.^{3,4} This reflects the idea that students learn not only through repetition with trial and error, but through social interactions, observing and modeling successes of others. As a result, while this simulation requires a facilitator ensure the required items are available it does not necessitate a facilitator be present over the entire duration. Participants perform common fishhook removal techniques with hands-on skill development using commercially available silicone sponge injection pad trainers.

Research Methods: Evaluating this small group session at a wilderness medicine training attended by medical and physician assistant students and their guests, self-reported confidence in fishhook removal before and after the simulation was assessed with a paired t-test. Survey results of perceived effectiveness and value of the simulation were also evaluated.

INNOVATIONS

Results: The average confidence increased 58% after the simulation ($p < 0.005$). The mean level of effectiveness was 87% and the participant perceived monetary value of the simulation materials was greater than actual cost.

Discussion: This innovation is a cost-friendly way to provide education and practice on fishhook removal. It requires minimal set up time and pre-learning can be easily modified to the expected knowledge and experience of participants. Understanding the fishhook removal techniques and increased levels of confidence has the potential to make participants more efficient when caring for patients. It may result in greater likelihood of success in removing fishhooks with minimal tissue damage.

Topics: Fishhook injuries, medical simulation, emergency medical education, wilderness first aid, wound management, injection pad trainers.



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Learner Audience:

Medical Students, Interns, Junior Residents, Senior Residents

Time Required for Implementation:

30-40 minutes

Recommended Number of Learners per Instructor:

4-6

Topics:

Fishhook injuries, medical simulation, emergency medical education, wilderness first aid, wound management, injection pad trainers.

Objectives:

By the end of the small group session participants should be able to:

1. Recall basic principles of wound management and indications for tetanus prophylaxis.
2. Verbalize fishhook terminology and describe the steps of different fishhook removal techniques.
3. Determine an appropriate fishhook removal method and safely demonstrate its use with proper patient positioning and minimal tissue damage.

Linked objectives and methods:

Self-directed and hands-on learning using charts and diagrams, and commercially available silicon sponge injection pad trainers that replicate human skin, make this small group session engaging and allows participants to effectively meet the session objectives.

A chart on tetanus prophylaxis and fishhook diagram prepared for the session allows participants to actively work together (objective 1). Having participants complete the chart and fill in the missing labels of the fishhook diagram—eyelet, shank, belly, barb, tip, brings context to the session and provides a basis to talk about and understand the fishhook removal techniques (objective 2).

Diagrams of well-known methods of fishhook removal are provided and briefly discussed, and the remaining time is spent on self-directed hands-on learning. The methods of fishhook

removal include the string technique, the push-through method, the needle (release) technique, and the cut it out technique. Participants attempt the different fishhook removal techniques excluding the cut it out technique on the injection pad trainer (objective 3).

Utilizing portable injection pad trainers requires no time to make or prepare a simulation model. Silicon gives the injection pad trainer a quality of skin resistance when removing the fishhook. Compared to previous simulations one benefit of the injection pad trainers is a potentially increased realism because of the ability to practice fishhook removal on different parts of the body. Injection pad trainers manufactured with a curved back allow them to fit securely on both distal extremities and the axilla. In addition to the main aspects of the fishhook removal techniques, participants learn patient positioning for maximum comfort and prevention of further injury. A dangling lure with multiple hooks on the foot or axilla hooks makes participants ensure their patient is not impaled a second time and that they readjust their patient during the removal of the fishhook. Participants learn strategies for and limitations of manipulating the hook, string, needle, and wire cutters. When cutting the hook participants learn to consider eye protection for themselves and their patient.

Durability of the pad allows for multiple attempts in performing each technique which is identified as valuable for improving the participants' skill development. Injection pad trainers show signs of use, however, do not develop any significant tears that prevent them from being reused for multiple small group sessions.

Recommended pre-reading for instructor:

Review the provided handouts. Previously published educational materials on wound management for fishhook injuries and removal can be reviewed by instructors on UpToDate through searching Fish hook removal techniques.⁶ We also recommend Chapter 45: Soft Tissue Foreign Bodies of Tintinalli's *Emergency Medicine: A Comprehensive Study Guide*, 9e and Chapter 26: Hunting and Fishing Injuries of Auerbach's *Wilderness Medicine*, 7e.^{7,8} Tintinalli's digital version has an accompanying instructional video performing fish hook removal on a cadaver. To note, while we feel the needle (release) techniques is an effective method with practice, in this video they do not recommend this method.⁷ Videos which demonstrate these various techniques on emergency department patients include those by Dr. Larry Mellick which can be found on YouTube.⁹



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Implementation Methods:

This small group session may best be implemented as an accompaniment to educational workshops with multiple stations. For example, this fishhook removal session was one of six stations at a wilderness medicine training event for medical and nonmedical participants. It requires three minutes to set out the items needed for the simulation. Each rotation is effectively carried out with four to six participants and runs approximately thirty minutes before participants transition to another station.

List of items required to replicate this innovation:

1. Laminated tetanus prophylaxis chart, fishhook diagram, and fishhook removal pictures
2. Dry erase markers
3. Injection pad trainers with straps
4. Various fishhooks and lures
5. Fishing line or string
6. Wire cutters and hemostat/pliers
7. 18-Gauge needles
8. Safety glasses

Approximate cost of items to create this innovation:

The commercially available silicone sponge injection pad trainers used for this simulation are low cost. At the time of purchase of the materials for our simulation each injection pad trainer cost approximately \$4.25 (when purchased as a set of eight). Twenty-five hooks of assorted sizes cost about \$5. Other items including pliers, hemostats, and eye protection are often readily found in the clinical setting and frequently carried by fishers.

Detailed methods to construct this innovation:

1. Have a facilitator collect all items required for this simulation. Commercially available silicone sponge skin injection pad trainers can be purchased online. The Silicone Sponge Human Skin Injection Pad (Manufacturer VturboWay 8.4x7.5x3.8cm, tape size 2.5cm width x 50cm length, bottom pad thickness: 2cm, practice sponge thickness: 1.8cm) is one example (Figure 2).⁵ This injection pad trainer has straps that allow it to be secured with hook and loop closures to different extremities. Have one trainer for every two people. Print the included handouts on tetanus prophylaxis and fishhook diagram, as well as the instructions of the fishhook removal techniques. Laminate materials to allow for use with dry erase markers and increase durability.

Tetanus prophylaxis chart and fishhook diagram:

Author's own image

Tetanus vaccine history	Clean and small wounds		Dirty and large wounds	
	Give vaccine	Give immunoglobulin	Give vaccine	Give immunoglobulin
< 3 doses or unknown	Yes	No	Yes	Yes
≥ 3 doses	If last dose > 10 years ago	No	If last dose > 5 years ago	No

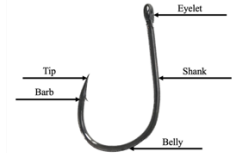


Figure 1: Tetanus prophylaxis chart and fishhook diagram bring added context to learning the fishhook removal techniques.

2. To begin the simulation, instruct participants to do the following tasks. Choose one participant to serve as scribe for the group as they fill in the tetanus prophylaxis chart and fishhook diagram. Answers should be checked with the answer key.
3. To prepare to perform fishhook removal, participants should partner up, with one participant being the health care provider and the other the patient. They will place the pads on the feet, legs, axilla, arms, and hands, and then impale and remove hooks and lures. In addition to the manufacturer suggestion of wrapping the straps twice when placing on a distal extremity, a gently tied water knot (ring bend) adequately secures the pad when impaling or removing a fishhook. If a facilitator is present, they may choose to place the pad and hook themselves, mimicking a patient presenting with a hook already embedded.
4. Participants should review the fishhook removal instructions and attempt one method at a time. After attempting all the methods, they will change roles with their partner. As participants practice the various techniques, they can be guided to assist the patient in moving into an optimal position. A table or bench can be made available to participants to stabilize body parts. A variety of hooks including simple single tip hooks sizes #22 to #6 and treble hooks sizes #10 to 1/0, with and without lures, are provided to impale into the injection pad trainers. Fishing line can be used as string for the string method. 18-Gauge 1" needles are used for the needle technique. When practicing the push-through method and cutting hooks with wire cutters, participants must use the provided safety glasses. Practicing the cut it out technique should be avoided as it will quickly destroy the injection pad trainers. Throughout the session, dust and dirt stuck to the silicon are easily removed with rubbing alcohol and a microfiber cloth.

Silicon sponge human skin injection pad trainer:

Author's own image



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Figure 2: Commercially available silicone sponge injection pad trainers allow participants to practice fishhook removal techniques on various body parts and learn patient positioning.

Results and tips for successful implementation:

To determine the effectiveness of this simulation it was implemented at an annual wilderness medicine medical student weekend training. Medical and physician assistant students from various medical schools in North Carolina, and their guests, were given surveys before starting and after completion of the simulation. Once collected, values of confidence and effectiveness in increasing skill-based competences that participants marked on a scale from low to high were measured with a ruler. The low end of the scale was given a value of 0% and high end was given a value of 100%. For participants who drew a circle on the line (n=12) the center of the circle was used to determine the percent value. A paired t-test was used to compare pre-simulation and post-simulation confidence. Histograms of survey answer distributions were binned up with intervals of 10. For perceived monetary value one participant responded with a range of values for which an average was taken.

Pre-activity and post-activity surveys were completed by 29/31 participants. As indicated by our survey results participants had some familiarity with fishing, fishhooks, and fishhook injuries, but not extensive knowledge or experience. 79% of participants had been fishing before (n=23). 14% of participants named two

parts of a fishhook, however, no participants correctly named three parts. 24% correctly answered that a 3/0 hook is larger than a #3 hook. 17% of participants had prior experience with fishhook removal. 17% of participants knew one or more fishhook removal technique. The pre-activity mean confidence was 17% with a standard deviation of 19 and the post-activity mean confidence was 75% with a standard deviation of 15. The difference in mean confidence before and after the simulation was 58% ($p < 0.005$). The mean level of participant perceived effectiveness of the simulation was 87% with a standard deviation of 14.

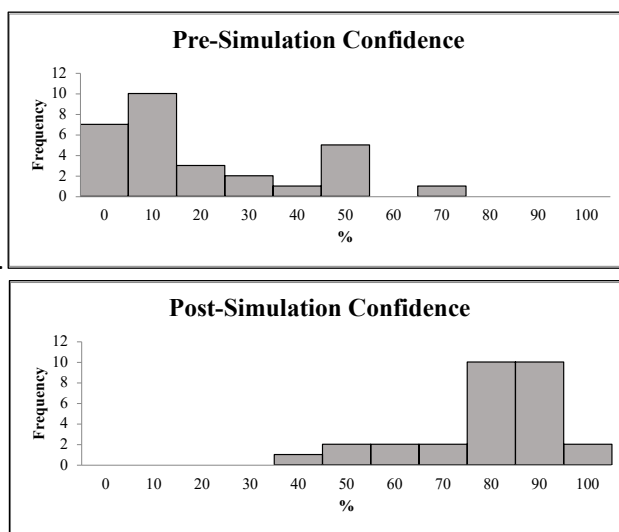
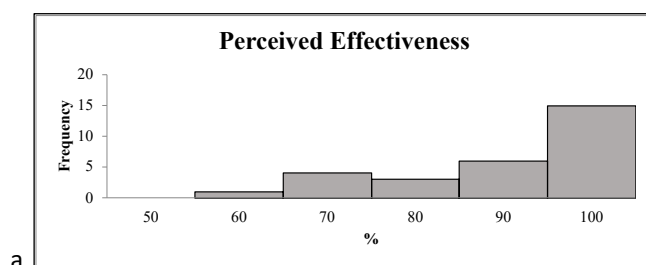


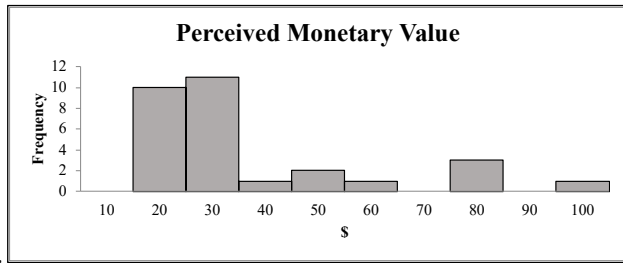
Figure 3: Histograms of pre-simulation confidence (a) and post-simulation confidence (b) show a significant increase.

All participants who completed the survey responded that the simulation increased their understanding of when to use a particular fishhook removal technique over another or what technique they would attempt first. The simulation also helped all participants understand something previously not understood about fishhook removal. Furthermore, 100% of participants who completed the survey responded that based on the experience with the simulation, fishhook removal is a skill that healthcare providers should practice prior to performing on a patient.





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b.

Figure 4: The distribution of participant perceived effectiveness of the simulation on increasing skill-based competency is high (a). Participant perceived monetary value of the simulation materials greater than actual cost (b).

For the push-through method, participants learned to invert the wire cutters when needed to cut the hook lower on the shank and gain a sense of the force needed to cut a variety of hooks. Initially participants commented on the difficulty of the needle method, however, they used this method in conjunction with the string technique. Through repeated attempts they learned that applying tension with the string allowed better visualization of the barb to both depress and disengage it with downward pressure and cover it with the needle. With practice, participants began to decrease tissue damage caused by large hooks by utilizing the needle to widen the entrance tract so they could more easily reverse the hook out of skin. It was observed that they also developed more proficiency in using the needle to release the small area of skin between the barb and rest of the hook. All these aspects likely factored into participants gaining increased confidence.

Based on our experience this simulation can be optimized for different teaching environments and skill levels. Lures that have treble hooks are typically more challenging to remove. As has been suggested in previous literature, participants can first cut the body of the lure or other parts of the treble hook away from the impaled hook to decrease the chance of secondary injury.⁸ Additionally, to increase the difficulty two of the barbs of the same treble hook can be inserted into the trainer or barbs of two different hooks on the same lure can be impaled. When considering eye protection for the push-through method, in addition to safety glasses and the use of hemostats to secure the tip, the hook can be covered with a cloth or bag prior to cutting.

Pearls:

1. Handouts on tetanus prophylaxis and the common parts of a fishhook with answer keys, along with instructions for fishhook removal methods, provide pre-learning for participants.
2. Silicon skin injection pad trainers can be secured to different body parts and impaled with various hooks in multiple configurations.

3. Students learn through observation of successful attempts and multiple repetitions of the string technique, the push-through method, the needle (release) technique for fishhook removal.

Associated Content:

- **Learner Materials**
 - Pre-activity Survey
 - Post-activity Survey
 - Tetanus Prophylaxis Chart
- **Instructor Materials**
 - Pre-activity Survey Answers
 - Tetanus Prophylaxis Chart Answers
 - Fishhook Removal Instructions

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<https://www.youtube.com/watch?v=NmKhQ3BK7LQ>



LEARNER MATERIALS

Marine Emergencies
Fishhook Removal

Name: _____
Affiliation: _____

Pre-activity Survey

Have you been fishing before? (Yes/No)

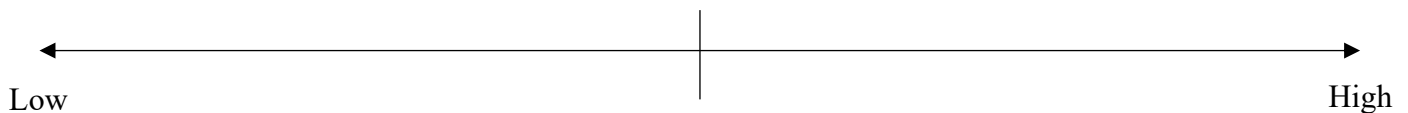
Can you name three parts of a fishhook?

What is larger a #3 or 3/0 (“three aught”) fishhook? (Circle)

Have you had prior experience with fishhook removal? (Yes/No)

How many fishhook removal techniques do you know? Please describe each in <5 words.

What is your level of confidence in performing fishhook removal? Please mark on the line below.





LEARNER MATERIALS

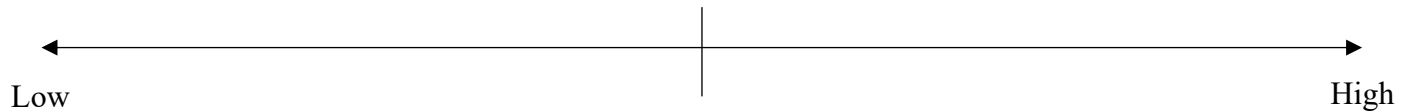
Marine Emergencies
Fishhook Removal

Name: _____

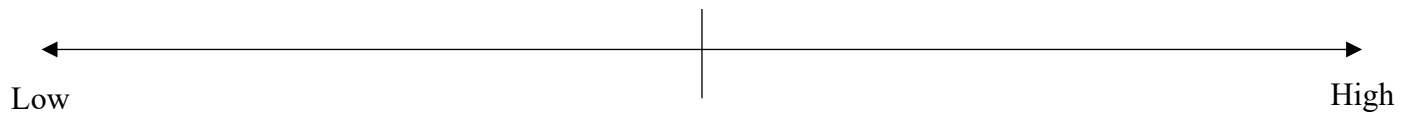
Affiliation: _____

Post-activity Survey

What is your level of confidence in fishhook removal after the simulation? Please mark on the line below.



What level of effectiveness did the simulation have on increasing your skill-based competency in fishhook removal? Please mark on the line below.



Did the simulation provide you with an increased understanding of when you might utilize a particular fishhook removal technique over another or what technique you might attempt first? (Yes/No)

What monetary value would you place on one trainer pad, several hooks, a needle, and string? (Number amount)

Did the simulation help you to understand something you previously did not understand about fishhook removal? (Yes/No)

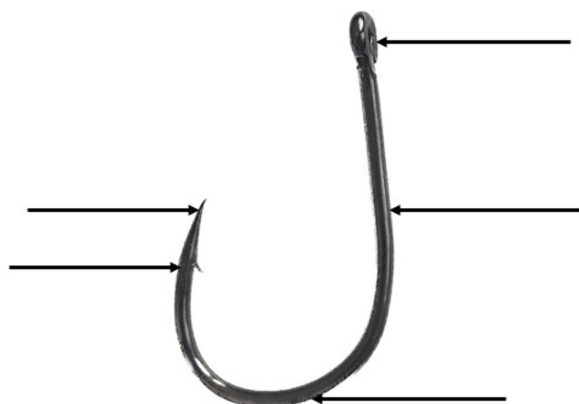
Based on your experience with the simulation, do you think fishhook removal is a skill healthcare providers should practice prior to performing on a patient? (Yes/No)



Tetanus Prophylaxis Chart

Tetanus vaccine history	Clean and small wounds		Dirty and large wounds	
	Give vaccine	Give immunoglobulin	Give vaccine	Give immunoglobulin
< 3 doses or unknown				
≥ 3 doses				

Fishhook Diagram





INSTRUCTOR MATERIALS

Marine Emergencies
Fishhook Removal

Name: _____

Affiliation: _____

Pre-activity Survey Answers

Have you been fishing before? (Yes/No)

Can you name three parts of a fishhook?

Answers: eyelet, shank, belly, barb, tip

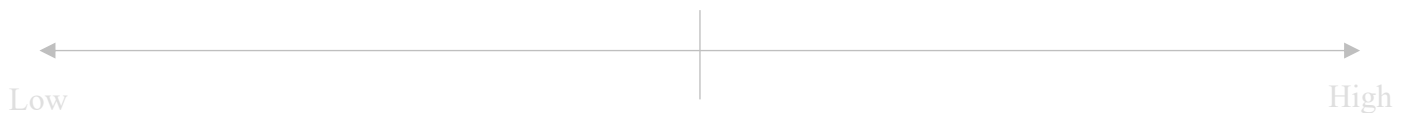
What is larger a #3 or 3/0 (“three aught”) fishhook? (Circle)

Answer: a 3/0 hook is larger than #3 hook

Have you had prior experience with fishhook removal? (Yes/No)

How many fishhook removal techniques do you know? Please describe each in <5 words.

What is your level of confidence in performing fishhook removal? Please mark on the line below.



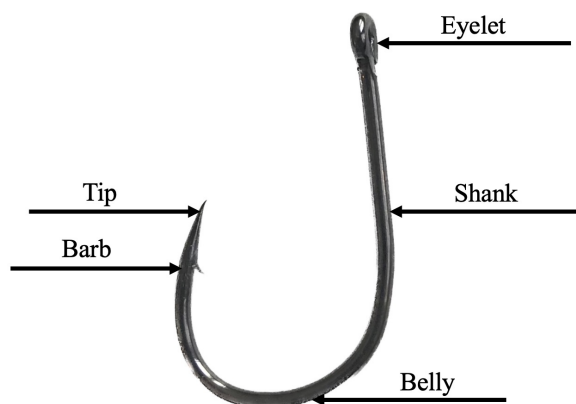


INSTRUCTOR MATERIALS

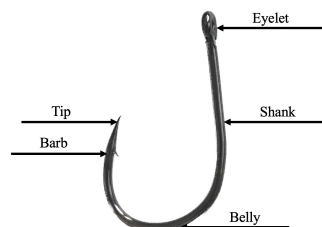
Tetanus Prophylaxis Chart

Tetanus vaccine history	Clean and small wounds		Dirty and large wounds	
	Give vaccine	Give immunoglobulin	Give vaccine	Give immunoglobulin
< 3 doses or unknown	Yes	No	Yes	Yes
≥ 3 doses	If last dose > 10 years ago	No	If last dose > 5 years ago	No

Fishhook Diagram

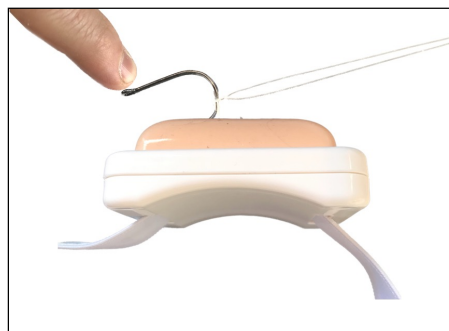


Fishhook removal instructions



String technique

- Tie fishing line or string around the belly of the hook.
- Depress the barb by applying pressure to the eyelet.
- Pull firmly on the string to remove the hook.



Needle (release) technique

- Grasp the eyelet of the hook with the nondominant hand.
- Apply gentle backwards pressure to the hook while advancing the needle along the entrance track.
- Proceed to advance the needle rotating around the hook slightly until the barb is covered.
- With both hands withdrawal the hook and needle simultaneously.



Push-through method

- Identify a safe path of the hook tip prior to advancing the hook.
- Grasp the eyelet and rotate the hook in the forward direction to push the tip through the skin.
- With adequate eye protection and the tip secured or covered, cut the hook below the barb.
- Grasp the eyelet and rotate the hook in the reverse direction until it is removed.

