Clinical Teaching Project

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Introduction:

This project presents a simulation-based instructional and assessment plan for teaching diagnostic paracentesis to third-year medical students during a three-week Hepatology clerkship. The components of the teaching project are as follows: 1) learning objectives, 2) teaching strategy, 3) reflective assignment, 4) assessment tool, and 5) reflection on peer feedback received. References are provided at the end followed by Appendix A which contains a procedural checklist that is otherwise referenced throughout the project.

Component 1: Learning Objectives

Learning Objective 1 (Affective)

- **Condition:** During a simulated clinical scenario in which a patient does not undergo diagnostic paracentesis because of an elevated INR,
- **Audience:** the medical student
- **Action:** will advocate for the safety of diagnostic paracentesis
- **Criterion:** by raising a concern about the deferral during the case presentation to the attending physician, as directly observed by faculty.

Why this objective is relevant: Elevated INR is frequently but incorrectly cited as a contraindication to diagnostic paracentesis and treating it as one unnecessarily delays a procedure and increases the risk of complications from a potential underlying infection. Both the American Gastroenterological Association and the American Association for the Study of Liver Diseases advise against routinely correcting coagulation parameters before low-risk procedures such as paracentesis (Biggins et al., 2021; O'Leary et al., 2019). This objective addresses the gap

by placing students in a realistic clinical scenario where an evidence-based procedure has been deferred, assessing whether they recognize that the presented rationale conflicts with guidelines, and whether they raise the concerns with the clinical team. Raising a concern within the clinical hierarchy is a difficult skill and is one that can be practiced prior to residency through simulation.

Learning Objective 2 (Psychomotor)

- **Condition:** Using a simulation model,
- **Audience:** the medical student
- **Action:** will demonstrate the technical steps of a diagnostic paracentesis
- **Criterion:** achieving a passing score of 80% or greater on the standardized procedural rubric as verified by a trained faculty observer.

Why this objective is relevant: Medical students frequently observe paracenteses during their rotations but rarely perform them, which creates a gap in both confidence and practical knowledge on entering residency. This objective bridges that gap by allowing for practice without the risks of patient harm. Barsuk et al. (2012) reported that internal medicine residents improved from a mean pretest paracentesis checklist score of 33.0% to 92.7% after a single three-hour session, demonstrating the effectiveness supporting this simulation activity.

Learning Objective 3 (Cognitive)

Condition: Given three clinical examples of ascitic fluid results,

- **Audience:** the medical student

- **Action:** will differentiate between portal hypertensive and non-portal hypertensive causes of ascites
- **Criterion:** by correctly interpreting the serum-ascites albumin gradient (SAAG) and ascitic fluid studies in at least two of three cases.

Why this objective is relevant: The differential diagnosis of ascites is broad, and the SAAG is one of the most important discriminators between portal hypertensive and non-portal hypertensive etiologies (Biggins et al., 2021). Recognizing the importance of SAAG calculation and interpreting other ascitic fluid parameters is key, as obtaining fluid is of limited value if students are unable to interpret the results.

Component 2: Clinical Teaching Strategies

Selected Learning Objective

- Using a simulation model, the medical student will demonstrate the technical steps of a diagnostic paracentesis, achieving a passing score of 80% or greater on the standardized procedural rubric as verified by a trained faculty observer.

Teaching Strategy: Peyton's Four-Step Approach

The strategy selected for this psychomotor objective is Peyton's Four-Step Approach. Developed initially for technical skills instruction in medical education, this strategy breaks down procedural skill acquisition into four steps:

1. Step 1: Demonstration. The instructor performs the procedure at normal speed without commentary.
2. Step 2: Deconstruction. The instructor performs the procedure while explaining each step in detail.
3. Step 3: Comprehension. The learner verbally guides the instructor through the procedure step-by-step while the instructor executes the physical actions.
4. Step 4: Execution. The learner independently performs the procedure while verbalizing their actions under direct observation.

Rationale

Peyton's Four-Step Approach was selected because it aligns closely with the psychomotor domain and reflects how adult learners acquire procedural skills through structured practical application. Third-year medical students often lack hands-on procedural experience,

which can generate anxiety and a gap in clinical confidence. By separating the cognitive load of a procedure (i.e., knowing what step comes next) from the mechanical load (physically conducting the step), Peyton's framework reduces the risk of cognitive overload especially during independent attempts.

Krautter et al. (2011) conducted a randomized controlled trial comparing Peyton's method to standard instruction ("see one, do one") for gastric tube insertion. Stepwise performance on a checklist did not differ between the groups, but students taught with Peyton's method scored higher on professionalism and communication, and completed their first independent performance much faster. Scaffolding is reinforced by using the same procedural checklist (Appendix A) that students receive during clerkship orientation, so the criteria on which they are judged are transparent and available from the beginning.

After the student completes an initial independent run-through, they perform one additional ungraded repetition of the full procedure while the supervising faculty member observes and completes the checklist. This allows for immediate corrective feedback, without any influence on the student's grade. The graded attempt follows, and any student who does not meet the passing standard on the graded attempt receives targeted remediation and a further attempt.

Examples

Example 1: ***Diagnostic Paracentesis***

Learner: Third-year medical student completing a specialty three-week clerkship in Hepatology.

- **Setting:** Simulation laboratory equipped with an abdominal task-trainer model containing simulated ascites, and sterile paracentesis kits.

- **Teaching Activity:** Procedural performance of a diagnostic paracentesis on a simulation model.
- **Description:** The faculty instructor demonstrates the paracentesis procedure skill through Steps 1 and 2 of Peyton's approach, physically modeling the Z-track needle insertion technique on the mannequin while describing the individual steps. The medical student then engages in Step 3 (Comprehension) by referencing their pre-briefing checklist and verbally instructing the faculty member on how to anesthetize the tissue, insert the needle, and aspirate the fluid. After the student relays the correct steps to faculty, they progress to Step 4 (Execution), where they independently perform the entire diagnostic paracentesis, first as an ungraded faculty-observed repetition with immediate feedback, and then as a graded attempt scored against the rubric.

Example 2: ***Adding Ultrasound Guidance***

- **Learner:** Third-year medical student who has already achieved the passing grade on the diagnostic paracentesis simulation.
- **Setting:** Simulation laboratory containing a high-fidelity abdominal model with fluid-filled internal compartments and a bedside ultrasound machine with an abdominal probe.
- **Teaching Activity:** Independent ultrasound landmarking and fluid pocket localization using a simulation model.
- **Description:** To develop the psychomotor skill of ultrasound-guided safe site selection, the faculty member demonstrates ultrasound probe manipulation and image optimization (Steps 1 and 2). The student then completes Step 3 (Comprehension) by verbally directing the faculty member’s hand movements to isolate a deep pocket of ascites while

avoiding simulated bowel. In Step 4 (Execution), the student independently manipulates the ultrasound transducer over the simulation abdomen to identify a fluid pocket with a minimum depth of 2 cm, confirms the absence of overlying loops of bowel, and marks the skin at a safe needle entry pathway while the faculty observer scores their performance using a standardized rubric.

Component 3: Reflective Practice

The reflective tool selected for this component is an individual narrative reflection assessed with the Reflection Evaluation for Learners' Enhanced Competencies Tool (REFLECT). Described by Wald et al. (2012) and validated in health professions education, the REFLECT tool classifies written reflection into four progressive levels: habitual action, thoughtful action or introspection, reflection, and critical reflection.

This tool is well suited for third-year medical students completing a procedural simulation during a three-week Hepatology clinical rotation. Peyton's approach (Krautter et al., 2011) addresses the cognitive load of the procedure; however, acquiring a procedural skill such as diagnostic paracentesis risks performance anxiety as well as cognitive stress, neither of which is addressed by Peyton's framework. I can personally attest to having had such thoughts during my own training. The REFLECT rubric provides a standardized framework that encourages students to move past a simple rehash of the procedural steps toward analysis of their own perceptions alongside their technical performance. Using a validated rubric also makes the expectations of meaningful reflection explicit, leveraging it as an objective tool for professional development rather than as an informal journaling task (Sandars, 2009; Wald et al., 2012).

Implementation

The reflective assignment and the REFLECT rubric criteria will be introduced during orientation of the Hepatology clerkship, along with the distribution of the diagnostic paracentesis procedural checklist (Appendix A). Following the simulation activity, students will complete an individual reflective assignment, roughly 300 to 450 words in length, requiring approximately 20

to 30 minutes. Students will be asked to electronically submit the assignment via email within two days of the session.

Writing prompts aligned with the REFLECT levels will be provided, for example: summarize your technical performance during the paracentesis session; analyze your thoughts and emotional responses during challenging components; and identify whether certain steps (e.g., identifying an appropriate pocket through ultrasound or demonstrating the Z-track technique) caused particular difficulty and why. Faculty will evaluate submissions and return written feedback using the REFLECT rubric within one week of submission indicating the level reached and specific comments. Wald et al. (2012) developed this rubric to guide individualized written feedback rather than generate a score.

All students will complete a 15-minute individual debrief in the week following the return of written feedback, which is feasible given the small number of students per simulation session. The debriefing follows the PEARLS framework (Eppich & Cheng, 2015), which combines learner self-assessment, focused facilitation, and directive feedback, and provides scripted language for each. Because a single faculty member reviews every reflection, there are no interrater reliability concerns; however, drift in one rater's interpretation of REFLECT levels is possible over time. Preparation would therefore consist of reviewing the four levels and their established anchors, as well as the PEARLS script to structure the conversation. Assuming this simulation activity persists over several years, review of earlier de-identified reflections from prior cohorts would also be of benefit to minimize rater drift over time.

Responses that fail to examine individual performance (i.e., at the habitual level) warrant particular attention during the debrief and guided prompting toward analysis. If students report

distress, loss of confidence, or fear of causing harm, these would be addressed directly and where appropriate referrals to student support services may be necessary.

Key Learnings and Insights

The primary gain expected from this assignment is increased awareness of personal procedural competence. Medical students frequently focus on the outcome of passing a checklist; this exercise instead requires them to analyze their technical execution and performance.

The reflection directly supports the learning objectives, in particular the psychomotor objective. A student might achieve the required 80% passing score on the rubric yet note a sense of unease during the needle insertion. By evaluating their experience through the REFLECT framework, students can examine why the unease occurred (e.g., poor bed height adjustments or suboptimal hand placement). This approach can help learners identify personal hurdles which can help bridge the simulation activity into a broader clinical context.

Application to Practice

The insights gained from this reflection will be important for future clinical rotations and residency training. Ideally, students will conduct mental walkthroughs prior to procedures to reduce performance anxiety and avoid technical omissions. Learners who identify physical discomfort or instability during the simulation activity learn to adjust bed height and optimize patient positioning in advance, improving both procedure safety and provider comfort.

Component 4: Assessment Tool and Scoring Rubric

Simulation Overview:

The assessment described here evaluates a third-year medical student completing a three-week Hepatology clerkship. Students perform a diagnostic paracentesis on an abdominal task-trainer model containing simulated ascites. This simulation session occurs in a small-group setting consisting of two medical students and one supervising faculty member. The session follows Peyton's Four-Step Approach, culminating in the student verbally guiding the instructor (Step 3: Comprehension) and then independently performing the procedure under direct faculty observation (Step 4: Execution), first as an ungraded practice attempt and then as the scored attempt.

Assessment Method:

Two instruments are used. The first is a diagnostic paracentesis procedural checklist (Appendix A), which serves as a written set of instructions to be used formatively by students throughout the simulation. The second is the simulation rubric, which grades the quality and independence of performance. Ilgen et al. (2015) found that checklists and rating scales carry comparable interrater reliability but capture different information, and the two instruments are therefore used in different roles. The rubric evaluates ten criteria on a three-level scale scored 5 (Proficient), 3 (Developing), and 1 (Unsatisfactory), for a maximum of 50 points. A pass requires two conditions, a cumulative score of at least 40 points (i.e., the 80% criterion as noted in Learning Objective 2), and no criterion rated Unsatisfactory. Failure on either condition requires targeted remediation and a repeat attempt.

An earlier version of this rubric used five performance levels and was reduced to three in order to improve the evaluator's ability to apply it consistently in real time, and have it completed within the time allotted during the simulation session. All simulation sessions are graded by the same faculty member, given the limited number of sessions and number of rotating students over the course of the year.

Assessment Implementation Plan

- What it is: An objective, rubric-based observational assessment designed to measure procedural competence, anatomical site selection, and sterile maintenance.
- Who will administer it: A single trained faculty member who supervises and grades all paracentesis simulation sessions during the clerkship.
- When it will occur: The assessment is administered in real time during the final portion of the simulation laboratory encounter, after the ungraded practice attempt.
- Duration: The active observation and scoring process takes approximately 15 minutes per student. An additional 5 minutes is allocated following the attempt for the faculty member to calculate the final score and deliver structured narrative feedback.
- Scoring: Ten criteria are scored 5, 3, or 1, for a maximum of 50 points. A pass requires a total of at least 40 points with no Unsatisfactory scored criterion.

Criterion	Score 5 (Proficient)	Score 3 (Developing)	Score 1 (Unsatisfactory)
Verbal Step Sequencing	Directs the instructor through the complete sequence in the correct order, without prompting.	Correct overall sequence with one minor omission or requires 1-2 verbal prompts from faculty.	Highly disorganized, cannot direct the procedure.
Pre-Procedural Preparation	Lays out paracentesis kit, verifies simulator positioning, and establishes an organized sterile tray before commencing.	Completes preparation with minor disorganization or requires 1-2 prompts to finalize setup; procedure safety unaffected.	Omits preparation, handles equipment incorrectly, or begins skin contact before the tray is ready.
Appropriate Site Selection	Identifies an anatomically safe site and justifies location, naming the structures being avoided.	Identifies a safe site but gives incomplete justification or requires 1-2 prompts to verify landmarks.	Selects an unsafe site posing a risk of injury or performs no anatomical site assessment.

Criterion	Score 5 (Proficient)	Score 3 (Developing)	Score 1 (Unsatisfactory)
Aseptic Technique	Performs hand hygiene, dons sterile PPE, applies chlorhexidine skin preparation, and maintains sterile field throughout.	Commits a minor breach of sterile field but recognizes it independently and self-corrects without faculty intervention.	Operates without regard for the sterile field, touches non-sterile structures with sterile instruments.
Local Anesthetic Technique	Identifies an appropriate needle path, aspirates to confirm lack of vascular structures, and demonstrates proper local tissue anesthetization.	Anesthetizes the path but skips negative pressure aspiration or requires 1–2 reminders to anesthetize down to the peritoneal layer.	Advances the procedure needle without local anesthetic, or injects anesthetic agent blindly in an unsafe manner.
Needle Insertion	Executes a correct Z-track displacement of the skin with	Demonstrates partial Z-track displacement or requires 1–2	Fails to perform any Z-track maneuver, advances the needle

Criterion	Score 5 (Proficient)	Score 3 (Developing)	Score 1 (Unsatisfactory)
	controlled advancement and an orientation appropriate for a diagnostic tap.	prompts but completes the insertion without a safety lapse.	in an uncontrolled fashion or at a dangerous angle despite prompting.
Fluid Aspiration	Aspirates simulated ascitic fluid, recognizes fluid return and handles the syringe smoothly.	Obtains fluid but fails to stabilize the needle during aspiration or requires 1–2 prompts to obtain the sample.	Fails to achieve fluid return, or causes significant needle displacement that would result in internal injury.
Specimen Collection	Collects the required volume of diagnostic fluid and names the standard diagnostic laboratory panels to order (cell count and	Collects the required volume but misses one or more diagnostic tests or requires 1-2 prompts to transfer fluid into the appropriate tubes.	Spills or contaminates the specimen, or displays no knowledge of the required laboratory panels.

Criterion	Score 5 (Proficient)	Score 3 (Developing)	Score 1 (Unsatisfactory)
	differential, albumin, protein, culture).		
Procedure Completion	Withdraws the needle smoothly, uses the needle safety cover, disposes of the needle into the sharps container, and applies a dressing.	Withdraws the needle safely but delays activating the safety cover or requires 1–2 prompts to appropriately dispose of the sharp or apply a dressing.	Leaves an uncovered sharp on the task-trainer, or handles disposal in a manner that creates a needlestick exposure risk.
Post-Procedure Care	Labels samples, reassesses patient vital signs, and states the complications to monitor for.	Describes post-procedure steps but misses one step, or requires 1–2 prompts for post-procedural assessment.	Demonstrates no understanding of post-procedure care requirements or leaves the simulation area unmanaged.

Summary

Cumulative Score: _____ / 50 points

Any criterion rated Unsatisfactory? Yes / No

Final Decision Outcome: Pass / Re-Attempt

(Pass = 40+ points and no Unsatisfactory criterion.

Re-attempt = <40 points or any Unsatisfactory criterion)

Component 5: Peer-Review Feedback Reflection

The peer feedback received was appreciated, and the recommended revisions strengthened the clinical teaching project. The wording in objective 1 was updated to reflect the proposed changes which will overall improve clarity for learners when preparing for the simulation. The suggestions provided for the clinical teaching strategies were especially helpful, and the importance of adding a non-graded practice session was integrated. A checklist (Appendix A) was also included for clarity as suggested. Regarding the reflective practice, the language regarding feedback was updated to reflect one week (rather than the five business days initially mentioned). Regarding the assessment tool, I did not add a faculty calibration process as all sessions are graded by a single faculty member given the small number of simulation sessions held each year. Should additional assessors become involved, calibration would be an important addition. Rather than peer observations, the practice attempt is supervised by faculty, as students at this stage would not yet have the experience to judge procedural performance reliably. Finally, the scoring rubric feedback was especially helpful as this was an area where I struggled. I integrated multiple areas of feedback including shortening descriptors and removing the categories for scores 2 and 4.

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Appendix A

Diagnostic Paracentesis Procedural Checklist

This checklist is distributed to students at the onset of the Hepatology clerkship rotation and is used formatively throughout the simulation. Each item is recorded as performed correctly or not performed correctly. This checklist does not contribute towards a student's grade.

Criterion	Key Steps	Yes	No
Verbal Step Sequencing	States the steps of the procedure in the correct order		
Pre-Procedural Preparation	Confirms the indication and consent, performs hand hygiene, positions the patient/bed.		
Appropriate Site Selection	Identifies the appropriate anatomical spot for paracentesis (left or right lower quadrant), avoiding vascular structures and underlying bowel		
Aseptic Technique	Dons sterile gloves and PPE, prepares the skin with chlorhexidine, and applies a sterile drape		
Local Anesthetic Technique	Creates a skin wheal on the task-trainer, and uses negative aspiration technique while advancing along intended track and anesthetizing all layers		

Needle Insertion	Displaces the skin to create a Z-track with the paracentesis needle while maintaining negative pressure		
Fluid Aspiration	Stops needle advancement after fluid return, stabilizes the needle, aspirates at least 30 mL of fluid		
Specimen Collection	Labels the tubes at bedside, and verbally states the studies to order (cell count with differential, albumin, total protein, culture), serum albumin for SAAG		
Procedure Completion	Withdraws the needle in a controlled manner, activates the safety lock, disposes of the sharp, and applies a dressing		
Post-Procedure Care	Reassesses vital signs, states complications to monitor for (bleeding or abdominal wall hematoma, persistent ascitic leak, bowel perforation)		