

Advanced Image-Guided Biopsy of Mesenteric Lymph Node: A Collaboration Between Interventional Radiologists and Surgeons to Optimize Augmented Reality Workflow

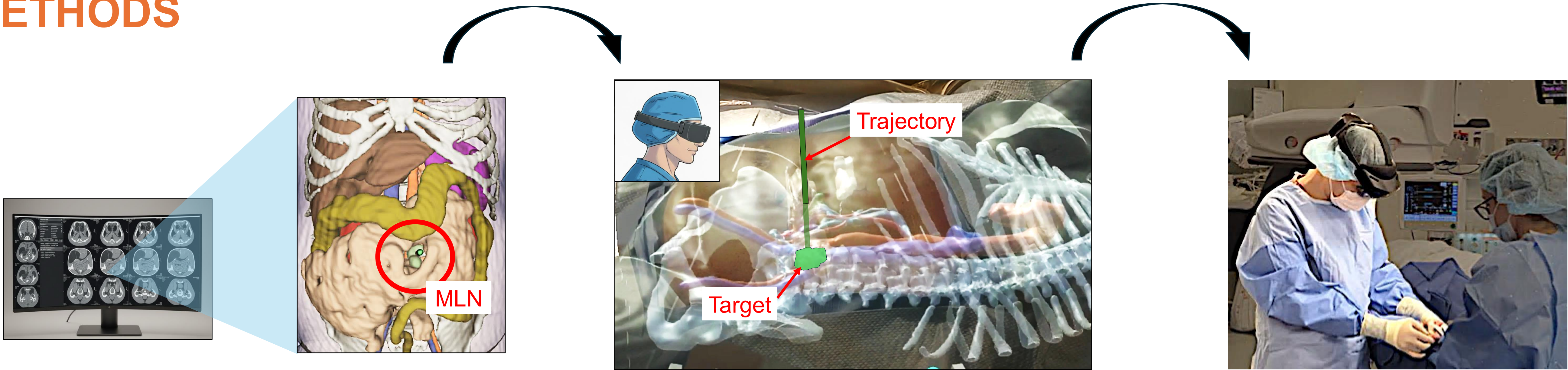
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INTRODUCTION: Mesenteric lymph node (MLN) biopsy is complicated due to target mobility and proximity to critical structures.

- **Current Challenges:** Safety concerns often hinder diagnostic capability and treatment options.
- **Potential of Augmented Reality (AR):** AR offers enhanced precision for mobile targets.
- **Objective:** Report our initial experience using AR-assisted image guidance for MLN biopsy.

METHODS



3D Modeling and Planning

- 3D segmentation of target MLN and mesenteric vessels from CT or MRI.
- Preoperative trajectory planning to avoid bowel and critical vasculature.

Co-Registration via AR

- 3D Hologram projection using AR Headset display (Microsoft HoloLens2).
- Manual co-registration using anatomical landmarks (ribs, umbilicus, anterior superior iliac spines, etc.).

AR-assisted MLN Biopsy

- Determination of the surface entry point based on projected trajectory.
- AR-assisted biopsy, supplemented by US or Fluoroscopy as needed.

RESULTS

- **100%** (4/4) definitive histopathological diagnosis.
- Skin incisions ranging from 2.0 to 8.0 cm.
- Discrepancy between planned and actual access points **< 1 cm**.
- 3 curative resections. 1 unnecessary surgery avoided. Most discharges within **0–2 days**.
- **Zero** procedure-related complications, reoperations, or readmissions.

Case	Max MLN Diameter (cm)	Planned Biopsy Approach	Incision Length (cm)	Diagnosis	LOS (days)	Clinical Outcome
1	2.0	Percutaneous Needle	N/A	Reactive lymphadenopathy	11	Surgery avoided
2	4.0	Laparoscopic-assisted needle	2.0	Neuroendocrine tumor	POD 0 discharge	Subsequent laparoscopic resection
3	3.1	Laparoscopic excisional	2.0	Lymphangioma	POD 0 discharge	En bloc resection
4	4.5	Open excisional	8.0	Metastatic adenocarcinoma	2	Curative resection

CONCLUSION / FUTURE DIRECTION

- **Proven Feasibility:** Successful and safe application of AR-assisted MLN biopsy.
- **Technical Precision:** Reliable target access and potential for less invasive approaches.
- **Surgical Innovation:** Practical AR solution for the long-standing challenge of targeting mobile intra-abdominal structures.