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ORIGINAL ARTICLE

Complications and management strategies in ultrasound-guided omental biopsies: A clinical cohort study of on-table interventions and outcomes in a Tertiary Care Hospital.

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ABSTRACT… Objective: To evaluate the frequency and nature of complications associated with ultrasound-guided omental biopsies and to assess the effectiveness of immediate on-table management strategies using a co-axial biopsy technique. **Study Design:** Prospective Observational Clinical Cohort study. **Setting:** Department of Interventional Radiology, Tertiary Care Hospital, Lady Reading Hospital, Peshawar. **Period:** June 2025 to June 2026. **Methods:** Included 115 consecutive patients undergoing ultrasound-guided omental biopsy using a co-axial core biopsy system. Demographic data, lesion characteristics, procedural details, complication rates, bleeding severity, and management strategies were recorded prospectively. Minor bleeding was managed using autologous clotted blood injection through the same c o-axial tract, whereas major bleeding was treated using Gel Foam slurry embolization followed by manual compression. Post-procedural ultrasound follow-up was performed to assess residual hematoma formation and delayed complications. **Results:** Among the 115 patients included in the study, 81 (70.4%) were female and 34 (29.6%) were male. Bleeding complications occurred in 12 patients (10.4%). Minor bleeding occurred in 9 patients (7.8%) and was successfully managed with autologous clot injection through the existing co-axial needle tract. Major bleeding occurred in 3 patients (2.6%) and was managed successfully using Gel Foam slurry embolization through the same tract followed by manual compression for 15 minutes. Technical success of hemostasis was achieved in 100% of complicated cases. No patient required surgical intervention, angiographic embolization, blood transfusion, or intensive care admission. Follow-up ultrasound demonstrated no residual hematoma or delayed bleeding complications. **Conclusion:** Ultrasound-guided omental biopsy using the co-axial technique is a safe, effective, and minimally invasive diagnostic procedure. Immediate management of bleeding complications through the same access tract significantly enhances procedural safety, minimizes patient morbidity, reduces resource utilization, and eliminates the need for additional invasive interventions.

Key words: Bleeding Complications, Co-axial Technique, Gel Foam Embolization, Interventional Radiology, Omental Biopsy, Percutaneous Biopsy, Ultrasound-guided Biopsy.

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INTRODUCTION

Omental thickening, nodularity, and mass lesions are frequently encountered during abdominal imaging and are associated with a broad spectrum of pathological conditions, including metastatic peritoneal carcinomatosis, abdominal tuberculosis, lymphoma, mesothelioma, and chronic inflammatory disorders.[1] Accurate histopathological diagnosis is essential because imaging findings alone are often nonspecific and insufficient for definitive characterization.[2]

Historically, surgical exploration and laparoscopic biopsy were considered the gold standard methods for obtaining tissue diagnosis from omental lesions. However, these techniques are invasive, associated with increased morbidity, longer hospital stay, higher procedural costs, and the requirement for general anesthesia.[3] With advancements in imaging and interventional radiology, image-guided percutaneous biopsy has become the preferred diagnostic approach because it is minimally invasive, cost-effective, and associated with high diagnostic yield and low complication rates.[4]

Among image-guided modalities, ultrasound guidance offers several advantages over computed tomography.

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Ultrasound provides real-time visualization, absence of ionizing radiation, portability, rapid procedural setup, and reduced procedural costs.[5] Furthermore, ultrasound permits continuous monitoring of the needle tip during insertion and sampling, thereby improving procedural precision and safety.[6] These advantages are particularly important in developing countries and resource-constrained healthcare settings.

The introduction of the co-axial biopsy technique has represented a major advancement in interventional radiology practice.[7] In this method, a larger introducer needle is first positioned into or adjacent to the lesion, after which multiple biopsy cores can be obtained through a single tract using a smaller cutting needle. This technique minimizes repeated tissue trauma, reduces procedural time, improves patient comfort, and decreases the risk of tumor seeding.[8]

Importantly, the co-axial system also creates an immediate access route for the management of procedural complications. Bleeding is the most common complication encountered during percutaneous omental biopsy because the omentum is highly vascular and often infiltrated by friable pathological tissue.[9] Although most bleeding episodes are self-limited, uncontrolled hemorrhage may occasionally necessitate embolization, surgery, or blood transfusion.[10]

The literature describing immediate tract-based management of bleeding complications during omental biopsy remains limited. Most published studies primarily focus on diagnostic accuracy and general complication rates rather than practical interventional strategies for complication control.[11] Techniques such as autologous clot injection and Gel Foam slurry embolization through the existing co-axial tract have not been extensively studied despite their potential effectiveness and simplicity.[12]

The present study was therefore designed to evaluate complication rates associated with ultrasound-guided omental biopsy and to assess the effectiveness of immediate on-table management strategies performed through the same co-axial access tract.

METHODS

This prospective observational clinical cohort study was conducted in the Department of Interventional Radiology at a tertiary care hospital from June 2025 to June 2026. Ethical approval was obtained from the institutional review board (461/LRH/MTI-26-08-25) prior to commencement of the study. Written informed consent was obtained from all patients before the procedure.

A total of 115 consecutive patients undergoing ultrasound-guided omental biopsy were included in the study. Females accounted for the majority of the group at 70.4% (81 individuals), while males made up the remaining 29.6% (34 individuals).

The study protocol was approved by the institutional ethics committee (Ref no 461/LRH/MTI). Patients were selected for the procedure based on specific inclusion and exclusion criteria. Inclusion required patients to have sonographically visible omental thickening or an omental mass, a clinical indication requiring histopathological diagnosis, lesions accessible under ultrasound guidance, and the ability to provide informed consent. Conversely, patients were excluded if they presented with uncorrected coagulopathy (INR >1.5), a platelet count below 50,000/mm^3, hemodynamic instability, inaccessible lesions on ultrasound, severe uncooperative behavior, or if they refused consent. Prior to the procedure, all patients underwent a detailed clinical evaluation, which included a review of their medical history, coagulation profile, platelet count, and cross-sectional imaging. The target lesion was localized using ultrasound, and relevant laboratory investigations were reviewed to minimize bleeding risk.

All biopsy procedures were performed by experienced interventional radiologists under strict aseptic precautions using real-time ultrasound guidance. The technical specifications included the use of a 16G Nipro co-axial introducer needle and an 18G core biopsy gun, with 2 to 5 passes made per patient. The procedural steps involved ultrasound localization of the target lesion, skin preparation with an antiseptic solution, and the administration of local anesthesia using lidocaine. The 16G co-axial introducer needle was then inserted into the lesion,

and multiple core biopsy samples were obtained through a single tract under continuous real-time ultrasound monitoring, followed by an immediate post-procedural ultrasound evaluation. By obtaining multiple tissue cores without repeated capsular puncture, tissue trauma was effectively minimized.

Intra-procedural bleeding was classified as either minor or major based on ultrasound findings and the patient's clinical status. Nine patients developed minor bleeding, which was defined by mild tract oozing, a small perilesional hematoma, no hemodynamic instability, and no significant active flow on Doppler imaging. These cases were managed using an autologous clotted blood injection through the same co-axial tract. Fresh autologous blood was collected, allowed to clot, and injected through the existing co-axial needle, followed by manual compression. This technique promoted immediate tract tamponade and avoided the need for additional punctures. Three patients developed major bleeding, characterized by significant active bleeding, persistent tract flow, an expanding hematoma, and hemodynamic concerns. These cases were managed by preparing a sterile gel foam slurry and delivering it directly into the bleeding tract under ultrasound monitoring, followed by 15 minutes of manual compression. Notably, no patient required escalation to angiographic embolization or surgery.

Following the procedure, all patients were observed clinically. Complicated cases underwent specific ultrasound follow-up to assess for residual hematoma, delayed hemorrhage, fluid collection, or active bleeding. Ultimately, no delayed complications were identified during the monitoring period.

RESULTS

TABLE-I

Overall Complication Rates

Type of Complication	Number	Percentage
No bleeding	103	89.6%
Minor bleeding	9	7.8%
Major bleeding	3	2.6%
Total bleeding	12	10.4%

FIGURE-1

Overall complication rates

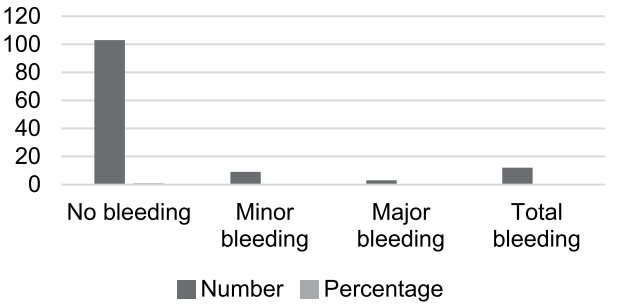


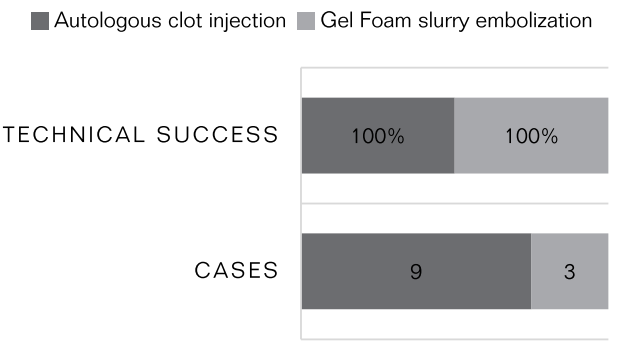
TABLE-II

Management Outcomes

Intervention	Cases	Technical Success
Autologous clot injection	9	100%
Gel Foam slurry embolization	3	100%

FIGURE-2

Management outcomes



Additional Outcomes

- No patient required surgery
- No angiographic embolization required
- No blood transfusion required
- No intensive care admission
- No mortality related to procedure
- No delayed bleeding detected
- No residual hematoma on follow-up ultrasound

The overall technical success rate of biopsy acquisition was 100%.

DISCUSSION

Image-guided percutaneous biopsy has revolutionized the diagnostic approach to intra-abdominal pathology by reducing the need for

surgical exploration and improving procedural safety[13]. Ultrasound-guided omental biopsy has emerged as a reliable technique because of its accessibility, cost-effectiveness, and real-time visualization capability.[14]

The present study demonstrated that ultrasound-guided omental biopsy using a co-axial technique is associated with a favorable safety profile and high procedural success. The observed overall bleeding rate of 10.4% falls within the range reported in previous studies of abdominal percutaneous biopsies, where complication rates vary between 5% and 15%.[15]

Most importantly, all bleeding complications in the present cohort were managed successfully using the same co-axial access tract without escalation to surgery or angiographic intervention. This finding highlights the major procedural advantage of the co-axial technique.

Minor bleeding occurred in 7.8% of patients and was effectively managed using autologous clot injection. This technique offers several advantages. It is immediately available, inexpensive, biologically compatible, and technically straightforward.[16] Injection through the same access tract creates localized tamponade and promotes hemostasis without introducing foreign embolic material.

Major bleeding occurred in only 2.6% of patients and was successfully controlled using Gel Foam slurry embolization. Gel Foam acts as a temporary embolic agent that promotes thrombus formation while preserving long-term vascular patency.[17] The ability to administer Gel Foam directly through the co-axial tract allowed rapid hemorrhage control without the need for angiography or additional puncture.

Previous studies have emphasized the diagnostic accuracy of ultrasound-guided omental biopsy but have provided limited discussion regarding immediate tract-based management of complications.[18] The present study therefore contributes practical interventional data relevant to modern interventional radiology practice.

The study also reinforces the broader principle that single-access intervention reduces procedural complexity, patient discomfort, tissue trauma, and healthcare resource utilization.[19] Avoiding escalation to angiographic embolization or surgery significantly decreases procedural costs and hospital burden, which is especially important in developing healthcare systems.

Another important observation in this study was the absence of delayed bleeding or residual hematoma on follow-up imaging. This suggests that immediate tract embolization techniques may provide durable hemostasis.

The high proportion of female patients in the present study likely reflects the increased prevalence of ovarian and gynecological malignancies associated with peritoneal dissemination and omental deposits.[20]

LIMITATIONS

Several limitations of this study should be acknowledged:

- Absence of a non–co-axial comparison group
- Moderate sample size
- Single-center study design
- Lack of long-term follow-up data
- No subgroup analysis based on lesion pathology

Future multicenter studies with larger patient populations and comparative designs are recommended to further validate these findings.

CONCLUSION

Ultrasound-guided omental biopsy using a co-axial core biopsy technique is a safe, minimally invasive, and highly effective diagnostic procedure. Bleeding complications can be managed successfully and immediately through the same co-axial access tract using autologous clot injection or Gel Foam slurry embolization. This approach minimizes procedural morbidity, avoids additional invasive intervention, reduces healthcare costs, and enhances overall procedural safety. The findings of this study support wider adoption of co-axial tract-based management strategies in interventional radiology practice.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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AUTHORSHIP AND CONTRIBUTION DECLARATION	
1	**Muhammad Kamran Khan:** Conception, study design, critical revisions.
2	**Syed Azam Shah:** Data collection, drafting.
3	**Tahira Nishtar:** Data analysis.
4	**Muhammad Abdullah:** Critical literature review.