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Original Research Article

Assessment of the Role of USG Guidance in Percutaneous Needle Puncture in Interventional Radiology

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Abstract

Aim: The aim of the present study was to assess the role of USG guidance in percutaneous Needle puncture in interventional radiology**.**

Material & Methods: A retrospectively analysed 2000 consecutive patients who underwent diagnostic or therapeutic intervention in division of Department of Radio-Diagnosis, Patna Medical College and Hospital, Patna, Bihar, India from October 2020 to November 2021. There were 1100 males and 900 females Age ranging from 1 month to 86 years with mean age of 46 years. All the patient had undergone vascular or other target access including non-pulsatile targets under USG guidance with single wall seldinger technique. Then patient either underwent diagnostic angiogram or interventional therapeutic procedure. Patient are assessed immediately after procedure and several days after that for any puncture site related complications

Results: We were successful in gaining the targeted access in all patients (100% success rate). Total complication rate was 1.5%.All of complications was treated conservatively. Femoral artery was the most common puncture site followed by saphenous vein over the ankle.

Conclusion: The importance of image guidance comparing with historical evidence. We strongly recommend use of USG guidance for Percutaneous puncture. Future studies will optimise the technique further to maximise the benefits to the patients

Keywords: USG, Percutaneous puncture, Interventional Radiology.

Introduction

Imaging-guided interventional techniques have brought about a revolution in the diagnosis and treatment of multiple diseases. [1] Since the 1980s, percutaneous biopsy has been performed under ultrasound guidance using spring-loaded biopsy needles, mainly in nephrological and radiological departments. First step for any Interventional radiology procedure is accessing a vessel or a cavity or any potential space or tissue(organ)by a percutaneous needle puncture. Seldinger involves three steps, first step is percutaneous puncture of vessel, step two is introduction of guide wire and removal of needle. Final step is introduction of catheter over guide wire. [2] Dr. Seldinger evolved these techniques because of severe complications associated with earlier technique of angiography which included vessel cut down, large bore metal trochar over wire, introduction of polythene tube through the cannula etc. Needle puncture under image guidance is always desirable to minimise puncture related complications. [3]

Fluoroscopy and CT were the earliest imaging techniques used for guidance of needle placement in interventional radiologic procedures. But their availability is not widespread. In the past two decades, among various guidance tools such as US, computed tomography (CT), and magnetic resonance (MR) imaging, Ultrasonography (USG)is preferred as first-line image guidance modality in interventional radiology procedures. Both USG and Radio-fluoroscopy have the advantage over CT scan as being a real-time imaging of a needle. CT fluoroscopy can image a needle in real-time, but this technique is associated with a higher radiation dose to the operator. The USG scores over fluoroscopy, CT, and CT fluoroscopy as it doesn't have risk of

ionizing radiation, USG has ability to visualize and avoid blood vessels without intravascular contrast material. It is portable and can be used as point care imaging modality. USG guidance is less expensive and easy to use than CT guidance. [4]

US has a number of advantages for guiding percutaneous biopsy, including wide availability, portability, lack of ionizing radiation, relatively short procedure time, real-time visualization of the biopsy needle and target lesion during the procedure, ability to guide the procedure in almost any anatomic plane, fewer false-negative biopsies, and relatively lower cost. [5,6,7] These advantages make US more effective than CT and MR imaging in obtaining safe access to the target lesions without the need to traverse non-target organs and vessels. The success of USPCB relies on various factors such as the radiologist's experience and knowledge about the procedure. Among these factors, continuous real-time visualization of the whole length of the biopsy needle, anatomic knowledge of the abdomen, and specific path of approach for specific

organs are all of great importance. [8] Hence the aim was to study the role of USG guidance in percutaneous Needle puncture in interventional radiology

Material & Methods

A retrospectively analysed 2000 consecutive patients who underwent diagnostic or therapeutic intervention in division of Department of Radio-Diagnosis, Patna Medical College and Hospital, Patna, Bihar, India from October 2020 to November 2021. There were 1100 males and 900 females Age ranging from 1 month to 86 years with mean age of 46 years.

All the patient had undergone vascular or other target access including non-pulsatile targets under USG guidance with single wall seldinger technique. Then patient either underwent diagnostic angiogram or interventional therapeutic procedure. Patients are assessed immediately after procedure and several days after that for any puncture site related complications.

Patients clinical and Procedure details are documented including puncture site, size of Needle and sheath, image guidance details, number of passes. Post procedure assessment includes about puncture site hematoma, pseudo aneurysm formation, nerve damage, infection, thromboembolic events, remote hematoma. Technical details of the procedure: Screening USG of the region of interest is to be done prior to procedure to assess acoustic window and to determine angle of insonation. Preparation of the field is with surface disinfectant and part draped keeping the window. The USG probe is sterilized or covered with rubber glove. We don't advocate of use needle guide in our department. We prefer a freehand approach. Local anaesthetic is administered with 23G needle and same is used to check the appropriateness of the acoustic window. Procedural needle 18 or 20G is then advanced until near wall of the vessel or cavity or outer margin of target organ. Then with gentle thrust needle is navigated into the lumen and backflow if any is checked. Appropriately sized wire is introduced which should move free into the target. Rest of the procedure is carried out as per Seldinger technique and procedure completed with adequate heparinisation. sheaths were removed after 2 hours with ACT value under 160 . 25 patients were who had undergone therapeutic intervention, sheaths were removed immediately after the procedure and puncture site sealed with closure devices.

Results

Table 1: Complications

Complications	Number of cases	Percentage
Hematoma	24	1.2
Psuedoaneuysrm	2	0.10
Infection	2	0.10
Thromboembolic	2	0.10
Compressive neuropathy	0	0
Retroperitoneal hematoma	0	0

We were successful in gaining the targeted access in all patients (100% success rate). Total complication rate was 1.5%.All of complications was treated conservatively.

Table 2: Various Locations for the puncture sites and various types of vessels and organs

Procedure puncture site	N
Femoral artery	1420
Radial Artery	10
Brachial artery	2
IJV	202

Subclavian Vein	15
Femoral vein	55
Billiary Tree	32
Pelvicaliceal system	5
Carotid artery	1
Veins draining Dialysis AV fistula	22
Saphenous Vein over the ankle	236
Total	2000

Femoral artery was the most common puncture site followed by saphenous vein over the ankle.

Discussion

Although pathologic examinations may not be routinely performed for various diseases of the abdominal viscera, they are often necessary because an imaging diagnosis can be declared inconclusive. Ultrasound-guided percutaneous core needle biopsy (USPCB) is an accurate, safe, and widely accepted technique for the tissue diagnosis of various lesions of the abdominal viscera. [9] Among various guidance tools such as US, computed tomography (CT), and magnetic resonance (MR) imaging, US has a number of advantages for guiding percutaneous biopsy for intra-abdominal lesions, including wide availability, portability, lack of ionizing radiation, relatively short procedure time, real-time visualization of the biopsy needle and target lesion during the procedure, ability to guide the procedure in almost any anatomic plane, fewer false-negative biopsies, and relatively lower cost. [10-12]

We were successful in gaining the targeted access in all patients (100% success rate). Total complication rate was 1.5%.All of complications was treated conservatively. Femoral artery was the most common puncture site followed by saphenous vein over the ankle. In a study by Zhang et al [13], the sensitivity of US-guided PCPNB in diagnosing malignancy was low (58.1%). However, 42.1% of all cases, including 44.2% of malignant cases, had pleural thickening of less than 3 mm. The thinner pleura are expected to impact the quantity of the biopsy specimen and thus its diagnostic sensitivity. Puncture site complications add to the morbidly-mortality of the already sick patients. USG guidance helps in minimising these complications. Interpretation of USG image and eye-hand coordination required to successfully complete the procedure. [14]

All pleural lesions with nodular morphology on CT had nodular morphology on US. However, among lesions with diffuse morphology on CT, approximately one-third had nodular morphology on US, and the diagnostic yield was 100% in such cases. Although CT provides a more comprehensive evaluation of the thorax, high-frequency US may have added value in the assessment of pleural lesions given the superficial location of such lesions. [15,16] Because US-guided PCPNB is operator dependent, the experience of the operator performing the procedure impacts the outcome of the procedure. [17,18] Complications associated with puncture are hematoma at puncture site or remote from puncture site, pseudo aneurysm formation, vessel laceration, compression neuropathy or traumatic nerve injuries, infection etc. Complications rates are significantly more in Landmark guided than image guided approach. [19-22] Greater success in subclavian vain cannulation using ultrasound for inexperienced operators as demonstrated by Gualtieri et al. [23]

Conclusion

USG guided percutaneous puncture has turned into founding landmark in radiology interventional Procedures. It reduces complications associated with punctures significantly. Reduction in procedure time and patient comfort are additional benefits leading to decrease in morbidity –mortality. Our study highlights the importance of image guidance comparing with historical evidence. We strongly recommend use of USG guidance for percutaneous puncture. Future studies will optimise the technique further to maximise the benefits to the patients.

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