Watch before you leap!

Ultrasound in Emergency Medicine

WHITE PAPER

June 2012

Dr. Bhaanu C. Shekhar

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Watch before you leap! Ultrasound in Emergency Medicine

This paper is not meant to provide a comprehensive detail regarding Ultrasound use in Emergency Medicine but, rather, a primer for residents new to emergency medicine as well as those with experience who are new to the field of emergency ultrasound.

The author sincerely hopes that this introduction will encourage doctors to explore this exciting field of Emergency Ultrasound and take steps to incorporate its use in their daily practice while caring for patients who require aggressive, time-bound, and accurate emergency medical care.

About the author

Dr. Bhaanu C Shekhar is a graduate of B. J. Medical College, Ahmedabad, India. After his medical schooling, he enrolled into the Fellowship in Emergency Medicine one year program at Indraprastha Apollo Hospitals, New Delhi, India. After completing the Fellowship course, he joined Apollo Health City, Hyderabad and successfully completed his MCEM residency training. During his residency, he also completed a 1-year Fellowship in Emergency Ultrasound.

He is currently working as Registrar in the Department of Emergency Medicine at Apollo Health City, Hyderabad. He is actively involved in research in Emergency Ultrasound and is actively pursuing this as his field of sub-specialty in Emergency Medicine. He is also a WINFOCUS Certified BL1 Ultrasound Provider.

Contact – bhaanushekhar1@gmail.com

"Think before you speak, and look before you leap…I won't admit my ignorance for the former, but with an ultrasound machine in my hand, I can appreciate the wisdom of the latter!"

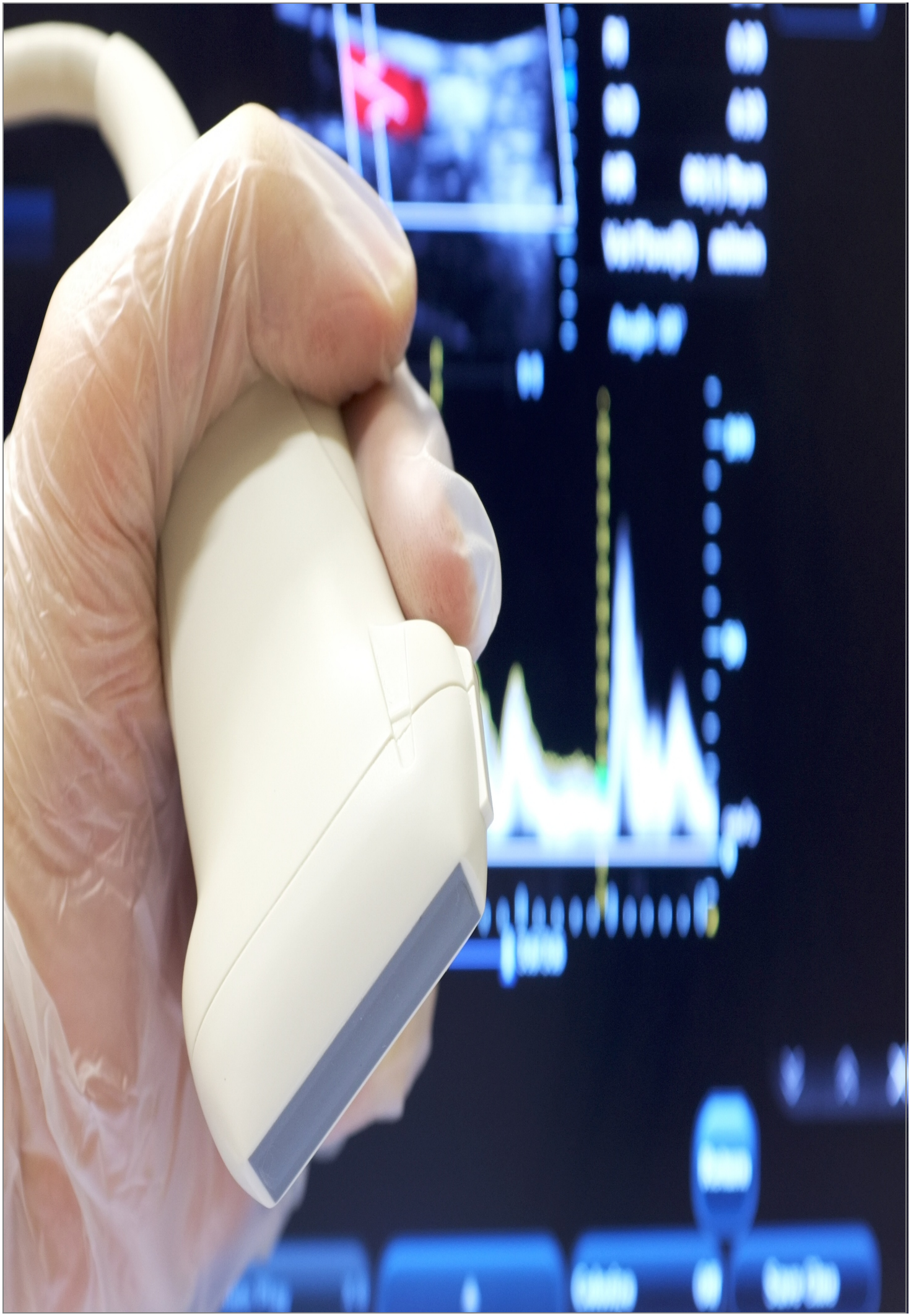
– Dr. Bhaanu C Shekhar

THE MILLION DOLLAR QUESTION

Emergency medicine is a very demanding, challenging and exciting branch which not only tests a physician's clinical skills, but also his communication abilities, interpersonal skills and importantly, his patience.

This is one branch where time is a premium, diagnoses unclear, and a need for quick, timely and accurate action, sometimes in not-so-friendly circumstances. Patients often present to an emergency physician at different points along the spectrum of their disease course and the clinical picture can be quite confusing.

In such a scenario, the clinician needs bed side investigative modalities that can help him refine the differential diagnoses and help guide the patient management in a safe and accurate way. Bedside emergency ultrasound has emerged as an ideal tool that answers these questions.



THE ROLE OF EMERGENCY ULTRASOUND

Emergency ultrasound essentially differs from standard radiology department ultrasound in that it is used to answer specific clinical questions at the bedside – a Yes/No answer rather than a general comment upon the organ visualized. What you decide to look for depends upon the case in hand and the clinical dilemma that needs to be answered on a case to case basis. It is a symptom, or a syndrome-based approach rather than an organ-based approach. For example, one of the most difficult and challenging cases seen in the emergency department is a patient with acute shortness of breath or abdominal pain. Does he have a respiratory or a cardiac cause for his complaint? Do I give a diuretic or fluids and antibiotics? Does he have a renal colic or cholelithiasis or an aortic dissection?

Bedside ultrasound helps in quickly ruling in or ruling out many conditions and helps a clinician in refining his differential diagnoses. There has been a paradigm shift in the way clinicians are now approaching many difficult clinical presentations with a 'Visual medicine' approach using bedside ultrasound.

BENEFITS OF BEDSIDE ULTRASOUND

Among the general benefits of ultrasound, are included the following-

1. No radiation
2. Safe in pregnancy
3. Cheap as compared to CT scans
4. Non-invasive, and
5. Painless

There are specific benefits of using ultrasound in emergency medicine, which include -

1. No interruption in resuscitation - including CPR (chest compressions)
2. Portable - the patient need not leave the ED
3. Safe
4. Rapid diagnostic tool
5. Useful even in unstable patients - who cannot be shifted out of ED for CT scans etc.
6. Sensitive
7. Clearly defined views to answer specific binary (Yes / No) clinical questions
8. Can change the management of the patient
9. Help identify life-threatening conditions quickly
10. Help narrow down and refine differential diagnoses
11. Safety during invasive procedures – "See and perform"

In-spite of the many uses of bedside emergency ultrasound, it must be emphasized that it is not a substitute for a formal ultrasound done by a radiologist. Bedside emergency ultrasound uses clearly defined and specific views only to answer certain clinical questions and provide binary answers – Yes/No. It is not a comprehensive examination technique and any positive finding in the emergency department, must be confirmed by a further radiologist-performed examination.

CLINICAL SITUATIONS WHERE ULTRASOUND CAN "CHANGE THE RULES OF THE GAME"

1. Shortness of breath - Cardiac tamponade
2. Shortness of breath - Right ventricular dilation suggesting massive Pulmonary Embolism
3. Shortness of breath - Pneumothorax
4. Shortness of breath - Poor cardiac contractility indicating Congestive heart failure / MI
5. Trauma with hypotension - Fluid in abdominal cavity (blood)
6. Abdominal pain with hypotension - Leaking abdominal aortic aneurysm / aortic dissection
7. Young female with hypotension and abdominal pain - fluid in abdominal cavity indicating possible ruptured ectopic pregnancy.

Each of these clinical conditions mentioned above can prove life-threatening, and most of the time, their clinical presentation overlaps other disease states. Ultrasound can quickly help the emergency physician take definitive management decisions within minutes and expedite patient care.

Apart of these, there are numerous other clinical conditions where bedside ultrasound has a role, like a patient with hip pain and fever where one can look for effusion suggestive of septic arthritis, or a soft - tissue swelling where cellulitis and abscess can be differentiated and in pediatric patients with suspected fractures.

Photo - An EM physician conducts a focused ECHO on a patient with shortness of breath

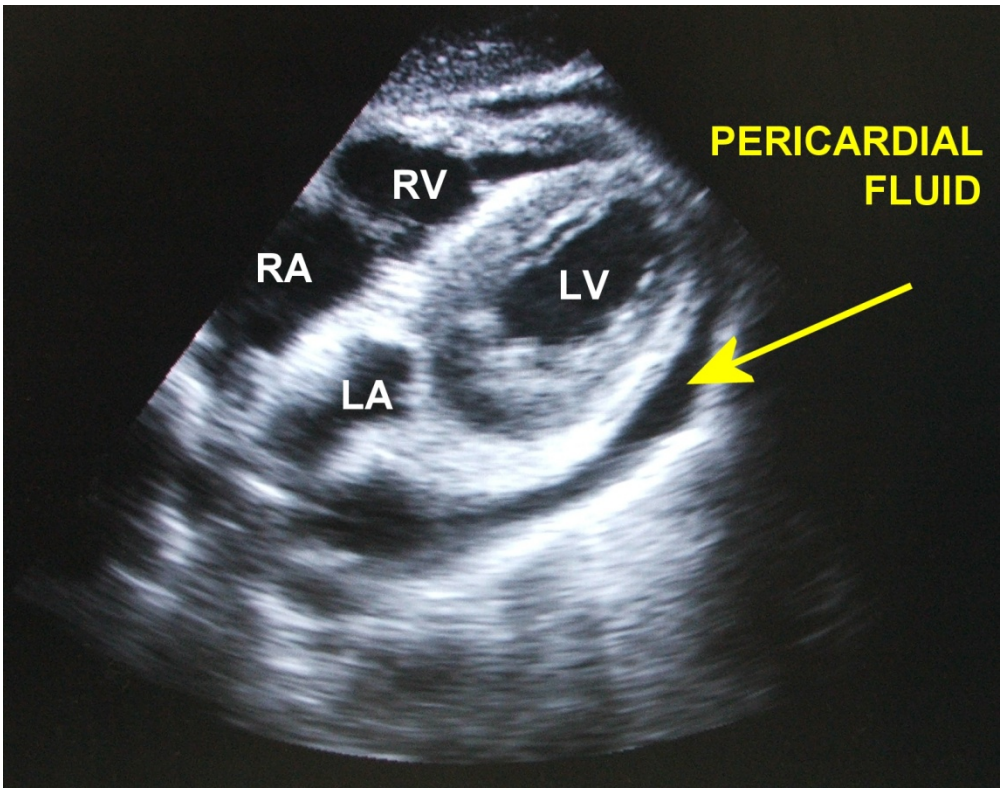


Photo – Pericardial effusion visible around the heart. The 4 chambers are clearly visible.

BROAD SCOPE OF EMERGENCY ULTRASOUND

Not just the emergency department, portable emergency ultrasound can be adapted for use in many pre-hospital scenarios where time is a premium, resources scarce and the patient may need to be transported to a medical facility. Some uses include but are not limited to-

1. Disaster on - field triaging
2. Wilderness medicine - forests, mountains etc.

LIMITATIONS OF EMERGENCY ULTRASOUND

Although it has many uses and can be adapted to various scenarios where sources may be scarce, ultrasound is not perfect as the machine cannot think or operate on its own. It requires a trained and efficient operator to use it, can then interpret the image correctly and arrive at the right decision. The various limitations of an ultrasound can be summarized as -

1. Operator dependant
2. Faulty image acquisition or image interpretation
3. Co-incident conditions - ultrasound findings may not necessarily explain the clinical picture.
4. Body habitus and air are known to limit ultrasound use and image acquisition.

THE IDEAL MACHINE

In the chaotic emergency department environs, the clinician is already hard-pressed taking care of multiple patients who may be of different age groups and differing severity of illness. The ideal point-of-care device that would help him rather than burden him, would be one which is* –

1. Portable – allows bedside use for all patients
2. Small – considering space constraints and hectic workload of the emergency department
3. Easy user interface – easily located and minimal number of knobs and switches
4. Less probes – multi-purpose probes would save time (while changing probes)
5. Easy to clean – a plastic sleeve for the probe along its length

Although many machines are available in the market, the search for the ideal machine continues.

* D.Lichtenstein. Whole body Ultrasonography in the Critically Ill.

TRAINING AND CERTIFICATION

Taking clinical decisions that are likely to impact patient care in a significant manner based on bedside emergency ultrasound findings, is fraught with danger as it could be potentially disastrous if the scan results are falsely interpreted. Appropriate credentialing and proctored training is a must to minimize errors in performance of the procedure as well as interpretation of the images. Often, decisions need to be taken quickly at the bedside in an emergency scenario and the ultrasound operator must be competently trained.

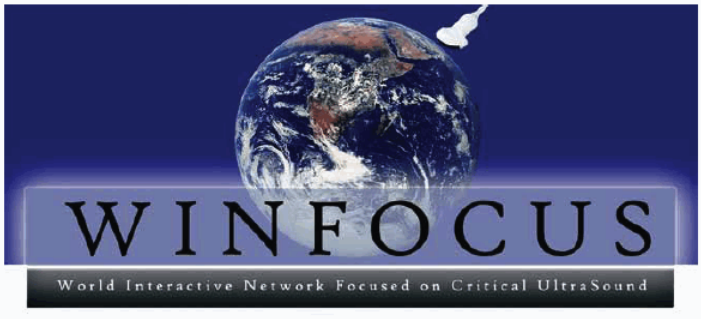
Both the American College of Emergency Physicians (ACEP) and Australasian College for Emergency Medicine (ACEM) have published policy statements on the credentialing process for emergency physicians. The Royal College of Radiologists has also published recommendations for training of non-radiologists in ultrasound. These are available at their respective websites - **www.acep.org** and **www.acem.org.au**

INTERNATIONAL CERTIFICATION PROGRAMS IN EMERGENCY ULTRASOUND

Many international certification programs are available for training and certification in emergency ultrasound. Most of these are either 2-day or 3-day programs which include basic and advanced training regarding the common uses of bedside emergency ultrasound. To name a few -

1. WINFOCUS (World Interactive Network Focused on Critical Ultrasound)
2. Gulf Coast Ultrasound
3. Australian Institute of Ultrasound

It has been shown in multiple studies worldwide that ultrasound can be easily taught to non-radiologists in two, three, or 4-day programs structured to provide basic training in ultrasound use in common emergency situations.



www.winfocus.org

CERTIFICATION PROGRAMS IN INDIA

Emergency ultrasound is still an unknown commodity in most emergency departments in India. Although there are many fellowships and training programs offered by different institutes in ultrasound, credentialing and training programs specific to emergency ultrasound training are far and few.

There are no national organizations focused on developing emergency ultrasound in the country as yet. But a few institutions with well-established emergency departments have been using bedside emergency ultrasound for the past few years and have training programs for the same. To name a few –

1. AIIMS (All India Institute of Medical Sciences, New Delhi) offers a 3-day training program in emergency ultrasound in trauma (AUTLS)
   www.aiimsultrasound.org

2. Department of Emergency Medicine, Apollo Health City, Hyderabad offers a 1-year Fellowship in Emergency Ultrasound during EM Residency training.

Also to be noted, national emergency medicine and critical care conferences now routinely include emergency ultrasound as part of their pre-conference workshops.

CHALLENGES IN INDIA

The first and foremost problem limiting the use of emergency bedside ultrasound in India is the lack of formal training programs in Emergency Medicine. Only recently, the Medical Council of India (MCI) has approved of a 3-year post-graduate training program in Emergency Medicine in India and that too is available in only a few institutions.

Institutions like Apollo Hospitals Hyderabad and Vinayaka Missions Salem, etc. have been training residents in emergency medicine since many years now but only few institutes have a formal training program designed to teach and impart knowledge regarding emergency ultrasound.

Another problem is the lack of infrastructure including proper machines and equipment. The various problems specific to the Indian scenario can be summarized as follows -

1. Lack of properly designed and committed emergency departments and training programs.
2. Lack of awareness regarding the potential of focused ultrasound in emergency medicine.
3. Lack of faculty to train physicians in emergency ultrasound.
4. Very few formally designed training programs in emergency ultrasound.
5. Lack of machines in most emergency departments.
6. No regulatory or training body at a national level.
7. No protocols for using / integrating ultrasound in routine emergency medicine training programs.
8. Restrictions imposed by the PNDT Act of Parliament allowing only registered and credentialed users to use ultrasound machines.

PNDT ACT IN INDIA

Because of the misuse of ultrasound machines for prenatal sex determination, the Government of India passed the PNDT Act (The Pre-Conception and Prenatal Diagnostic Techniques Act), 1994, which limits the use of ultrasound machines only in the hands of certified and registered users.

How this act will affect the use of ultrasound machines in the emergency departments remains to be seen as the potential for misuse is accepted but at the same time, the potential of ultrasound in helping make correct clinical decisions is also significant. Details of the PNDT Act and what it entails can be found on the website – **www.pndt.gov.in**

STARTING AN EMERGENCY ULTRASOUND TRAINING PROGRAM

The American College of Emergency Physicians (ACEP) has published policy guidelines regarding how to set up an ultrasound in the emergency department and the details are available on ACEP'S website (**www.acep.org**). The basic training structure of an emergency ultrasound program can be described as having the following -

1. An Ultrasound Director - Certified and credentialed to teach Emergency Ultrasound.
2. Ultrasound Fellows (Registrars/Senior residents) trained and certified in Emergency Ultrasound - to provide hands-on training for residents.
3. A structured Training program- in the second and third years of EM residency training.
4. Basic and Advanced levels of training with practical and theory exams.
5. Training should be designed to improve –
    a. Psychomotor skills (for using the machine)
    b. Reasoning ability and Image interpretation
    c. Clinical integration of the findings
6. Maintenance of a log book of cases including images and final radiological reports.
7. Images to be reviewed regularly by Senior Ultrasound Fellows and/or Director for accuracy.
8. A good working relationship with the Radiology Department.
9. Having a Journal Club - review of latest literature and case presentations.
10. An emphasis on Research in Emergency Ultrasound.
11. Clinical Departmental Protocols incorporating ultrasound use - e.g. undifferentiated abdominal pain, shortness of breath etc.
12. Quality control measures to improve departmental functioning.
13. Medical simulation workshops should be integrated with ultrasound hands-on training.
14. Quarterly, six-monthly and annual ultrasound training workshops to ensure skill retention and up-gradation.

Since there are very few structured training programs in India in emergency ultrasound, there is scope for improvement.

SO YOU ARE INTERESTED IN EM ULTRASOUND

Having read thus far, if you find yourself interested in Emergency Ultrasound, where should you start? The following recommendations are only meant to be used as a guide for beginners and are by no means comprehensive –

1. Read more about Ultrasound use in Emergency Medicine. A few standard reference books are mentioned below.

2. Find out about institutes near you who offer structured and certified training in emergency ultrasound. BEWARE – the institute should be reputed and should ideally have an emergency medicine residency program also.

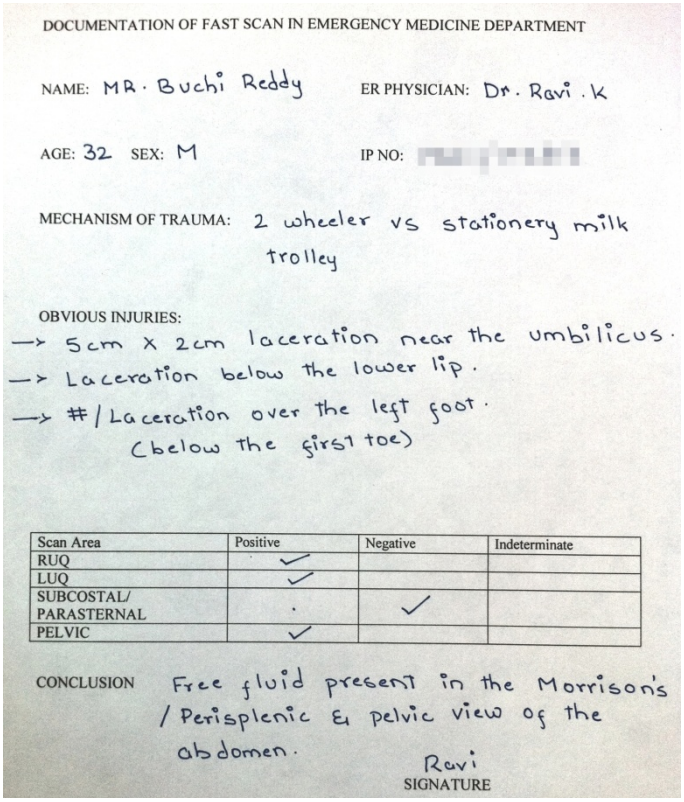
3. Details about the training courses conducted at AIIMS and Apollo Hyderabad can be found on their respective websites. There may be other certified institutes also. Get yourself enrolled for a course either at an institute or in a pre-conference workshop.

4. Once trained in basic emergency ultrasound, start logging cases including the indications for the scan, the views used, and the images. Ideally, the final radiologist's report should also be added to the log.

5. Get your images checked for accuracy and detail by an expert.

6. DO NOT take clinical decisions based on your ultrasound findings unless you are supervised or adequately experienced in using ultrasound.

7. You may need to get yourself and your ultrasound machine registered with the proper authorities before you start using them. (Ref-PNDT Act)



DOCUMENTATION OF FAST SCAN IN EMERGENCY MEDICINE DEPARTMENT

NAME: MR. Buchi Reddy ER PHYSICIAN: Dr. Ravi. K

AGE: 32 SEX: M IP NO: [redacted]

MECHANISM OF TRAUMA: 2 wheeler vs stationery milk trolley

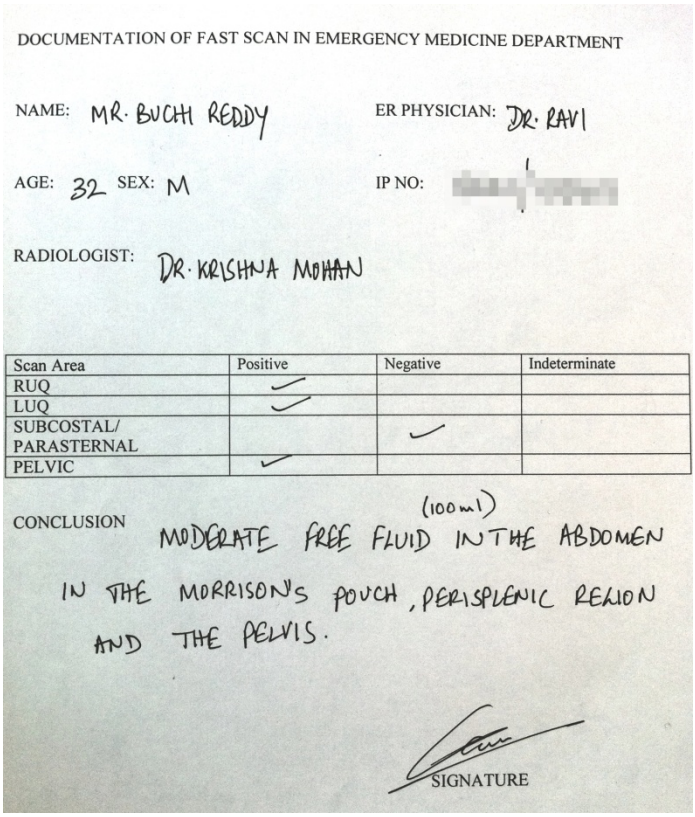
OBVIOUS INJURIES:
—> 5cm x 2cm laceration near the umbilicus.
—> Laceration below the lower lip.
—> #/Laceration over the left foot. (below the first toe)

Scan Area	Positive	Negative	Indeterminate
RUQ	✓		
LUQ	✓		
SUBCOSTAL/ PARASTERNAL		✓	
PELVIC	✓		

CONCLUSION Free fluid present in the Morrison's / Perisplenic & pelvic view of the abdomen.

Ravi
SIGNATURE

Photo – Documentation of FAST scan done by an EM resident in a trauma patient.



DOCUMENTATION OF FAST SCAN IN EMERGENCY MEDICINE DEPARTMENT

NAME: MR. BUCHI REDDY ER PHYSICIAN: DR. RAVI

AGE: 32 SEX: M IP NO: [redacted]

RADIOLOGIST: DR. KRISHNA MOHAN

Scan Area	Positive	Negative	Indeterminate
RUQ	✓		
LUQ	✓		
SUBCOSTAL/ PARASTERNAL		✓	
PELVIC	✓		

CONCLUSION MODERATE FREE FLUID (100ml) IN THE ABDOMEN IN THE MORRISON'S POUCH, PERISPLENIC REGION AND THE PELVIS.

SIGNATURE

Photo – Confirmatory note by radiologist.

ONE YEAR FELLOWSHIP IN EMERGENCY ULTRASOUND AT APOLLO HEALTH CITY HYDERABAD

Apollo Hospitals, Jubilee Hills, Hyderabad, offers a 1-year Fellowship in Emergency Ultrasound to its residents enrolled in the emergency medicine post-graduate training program. This fellowship has been designed along the ACEP'S guidelines for ultrasound fellowships.

The fellowship is offered to residents in their second and third year of EM residency training. The candidates undergo proctored training at the bedside supervised by ultrasound fellows who have completed the fellowship and have competency-based certification from WINFOCUS as emergency ultrasound providers. The program director is an international WINFOCUS faculty who supervises the whole training program including audit of images, conducting workshops and lectures.

The candidate is required to keep a log of (a minimum of) 30 cases each for six category of scans commonly indicated in the emergency department – renal, biliary, abdominal aorta, FAST (focused assessment with sonography in trauma), ultrasound guided central and peripheral venous access, and focused cardiac ultrasound (2D Echo). All images are checked for accuracy and completeness of detail by senior fellows and director, and cross-checked with the radiologist's findings. In addition, at least 400 supervised scans must be performed within independent ultrasound shifts over the year.

Clinical decisions based on bedside ultrasound scan findings are supervised by senior registrars certified in emergency ultrasound and the director. This ensures accuracy while performing the scan, a good understanding of why the scan is indicated, and safety while interpreting the images to take guided clinical decisions. As a department policy, all central venous catheter placements are done with ultrasound guidance. New concepts like lung ultrasound and protocols, and use in head trauma continue to be explored.

SOME HELPFUL WEBSITES

- www.winfocus.org
- www.acep.org
- www.aium.org
- www.bmus.org
- www.baem.org.uk
- www.apollohospitals.com
- www.emergencymedicine.in

BOOKS FOR REFERENCE

- Emergency Ultrasound - by John Ma, James Mateer
- Whole body Ultrasonography in the Critically Ill - by Daniel Lichtenstein
- Emergency Ultrasound Made Easy - by Justin Bowra
- Ultrasound in Emergency Care - by Adam Brooks, Jim Connolly

SUMMARY

Emergency Ultrasound can be correctly called an extension of the stethoscope and the palpating hand of the clinician. It allows one to practice 'Visual medicine' and take better clinical decisions in clinical scenarios where presentations overlap many disease entities. Its use is well established in trauma and its use is increasing in non-trauma settings.

ACEP has stated - **"Emergency physicians regardless of practice, location or type, should be encouraged to adopt this extraordinarily useful modality in the leading decade of the 21st century."**

Ultrasound helps bridge emergency medicine with other specialties and will continue to do so.

This paper is not meant to provide a comprehensive detail regarding Ultrasound use in Emergency Medicine but, rather, a primer for residents new to emergency medicine as well as those with experience who are new to the field of emergency ultrasound. The author sincerely hopes that this introduction will encourage doctors to explore this exciting field of Emergency Ultrasound and take steps to incorporate its use in their daily practice while caring for patients who require aggressive, time-bound, and accurate emergency medical care.

SONO ?

SO YES !!

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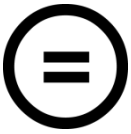

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EMinside Editor
emergencymedicine.inside@gmail.com

EmergencyMedicine.in
101, Silver Oak, Amrutha Valley, Road 12
Banjara Hills, Hyderabad – 500034 INDIA

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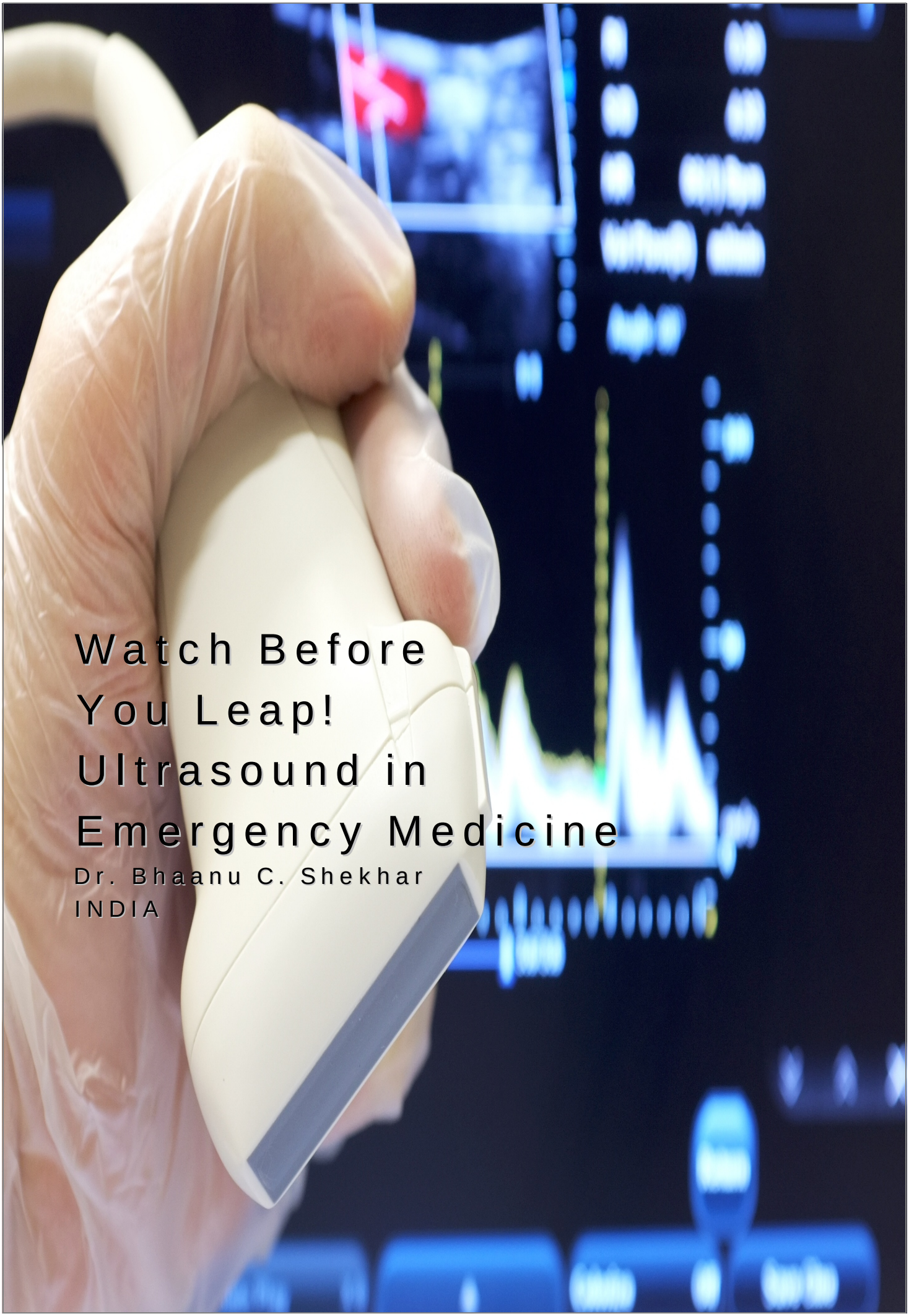

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