To study the impact of Sono-triage in identifying the under-triage rate among yellow triage patients during mass casualty incidents at level one trauma centre

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Background

- Mass casualty incidents (MCI's) need quick & reliable triage of large numbers of injured patients.

- Protocol based triage is critical during MCI's with acceptable under-triage & over-triage rate.

- Under-triage during MCIs using existing triage tool may lead to delay in critical management decisions challenging patient safety.[1]

- Point of care sonography may optimize the existing trauma triage tool.[2]

Ashkenazi I et.al. Precision of in-hospital triage in mass-casualty incidents after terror attacks. Prehosp Disaster Med. 2006 Jan-Feb;21(1):20-3.
Richards JR, et.al.State of the art;Focused Assessment with Sonography in Trauma (FAST) Radiology. 2017 Apr;283(1):30-48.

OBJECTIVE

Primary objective

- To study the under-triage rate among yellow triage patients by using Sono-Triage (ST) done by nurses

Secondary Objective

- To compare the inter-rater agreement with radiologist.

Methodology

Study design : Retrospective chart review .

Study site – Emergency department of JPN Apex Trauma Centre, AIIMS New Delhi

India

Study setting & Duration

Four MCIs events during 2019 to 2023

Study Subjects - All Yellow triaged patients (as per AIIMS trauma triage protocol)

Yellow Triage Criteria

- Vital function (ABCD)

- Identified injuries

- Mechanism of injury

- Trauma patients requiring investigation and/or observation apart from care.

Comparison of Yellow triage

AIIMS triage protocol versus other triage tool

ESI triage category	CATS triage category	MTS triage category	ATS triage category
3 & 4	IV	3	4

Training of Nurses - Sono-Triage

10 Nursing participants per course

4 Hours Module

1hour – lecture
3hours - skills

Hands-on learning

Ultrasound basics knobology,
Extended FAST

20 E-FAST scans

To Rule out the performer bias

5 - positive scan
15 - normal scan

E- Fast Review

By Senior Emergency Faculty before recruitment of patients

Certification

based on participant's performance

Process

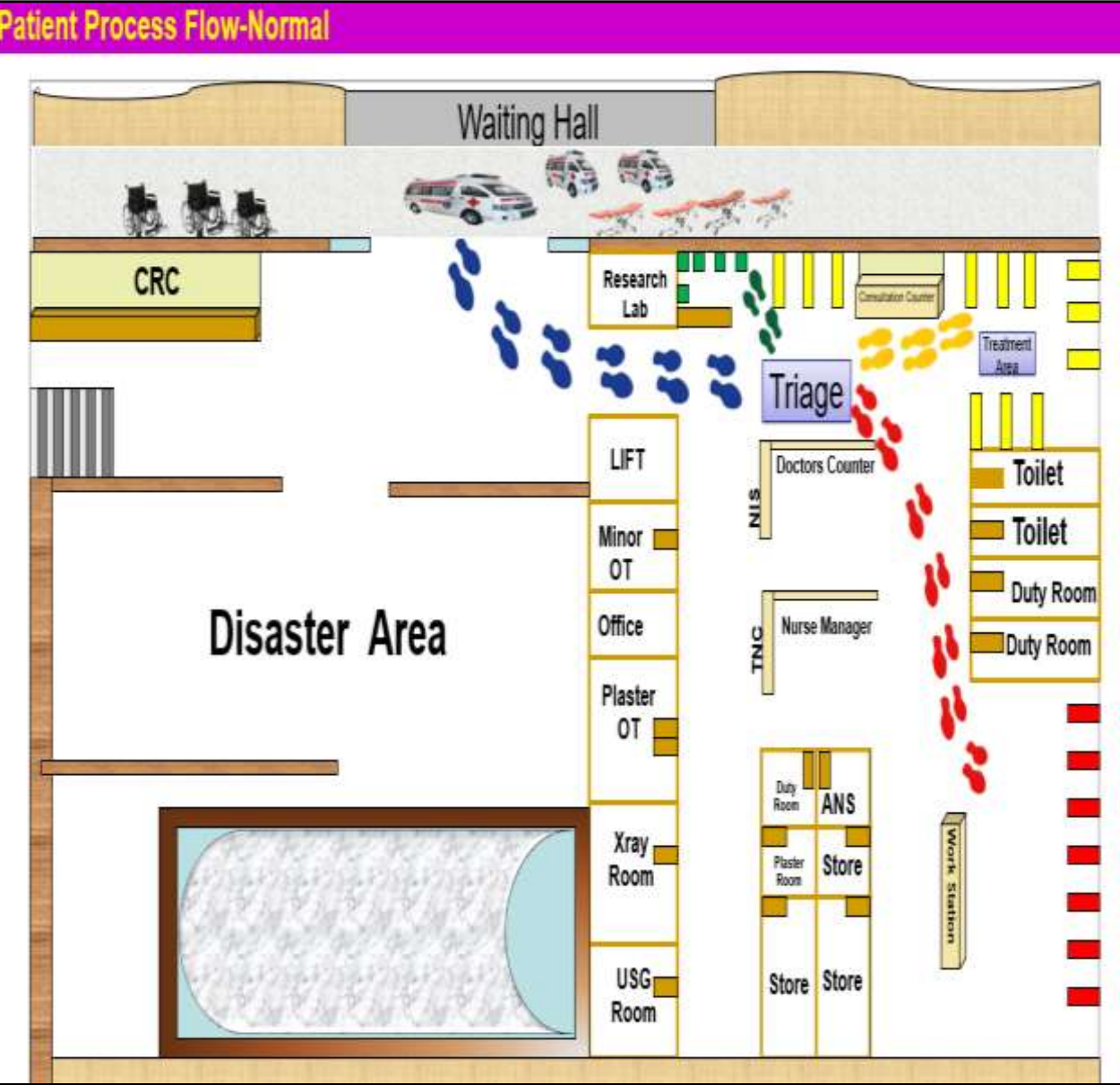## MCI Preparedness & Patient flow

HOLI – Expected MCI

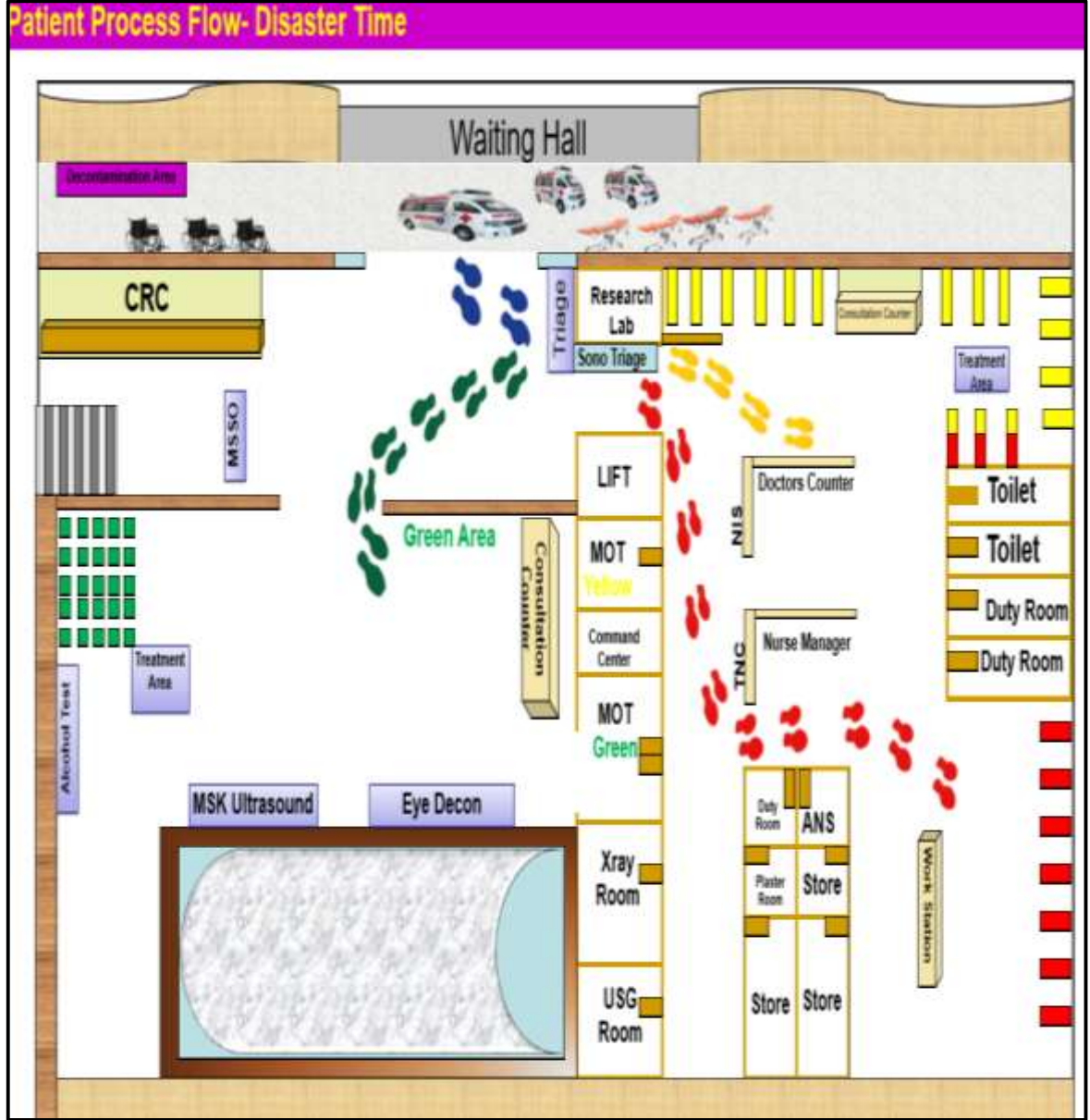## Holi- A festival of colors, celebrated every year

Usual = Av. 200 patients/day
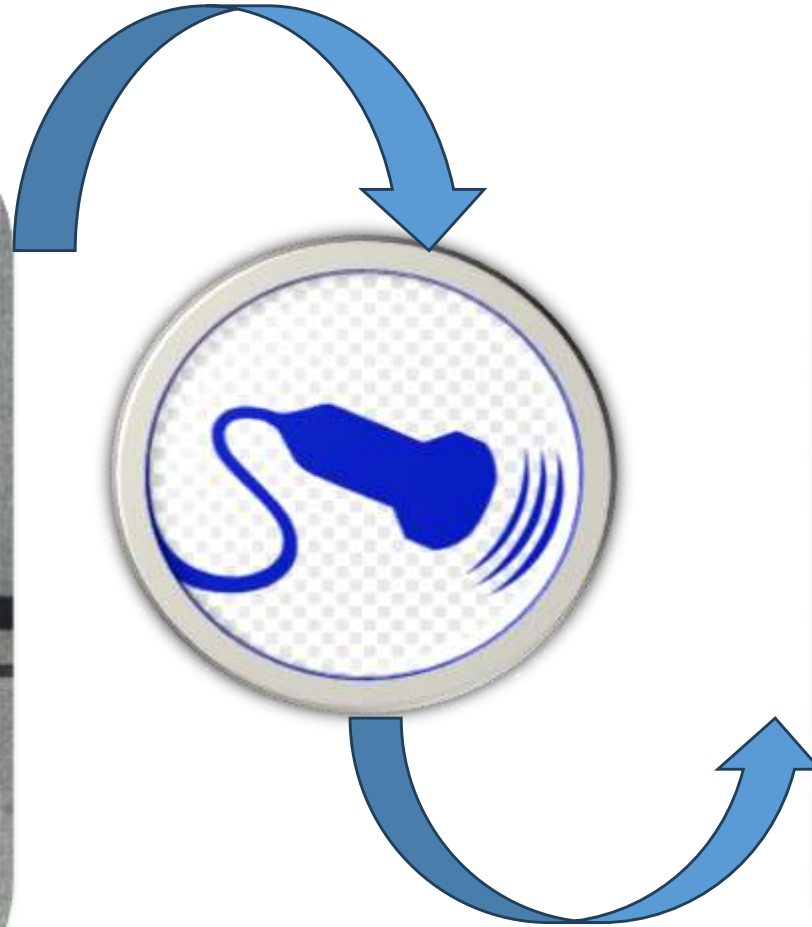**MCI = 400 patients/day (approx. 250 over 8hrs)**

Patient process flow Usual days

Patient process flow in Mass casualty

Nurse led Triage & Sono Triage

MCI Preparedness - Table top drill

Methodology

- **Study Subjects** - All Yellow triaged patients underwent Sono triage (E-FAST scan) by trained nurse.

- Subsequently E-FAST scan done by radiologist within 15 minutes of triage.

- Findings were documented & Inter-rater agreement & under-triage rate were calculated.

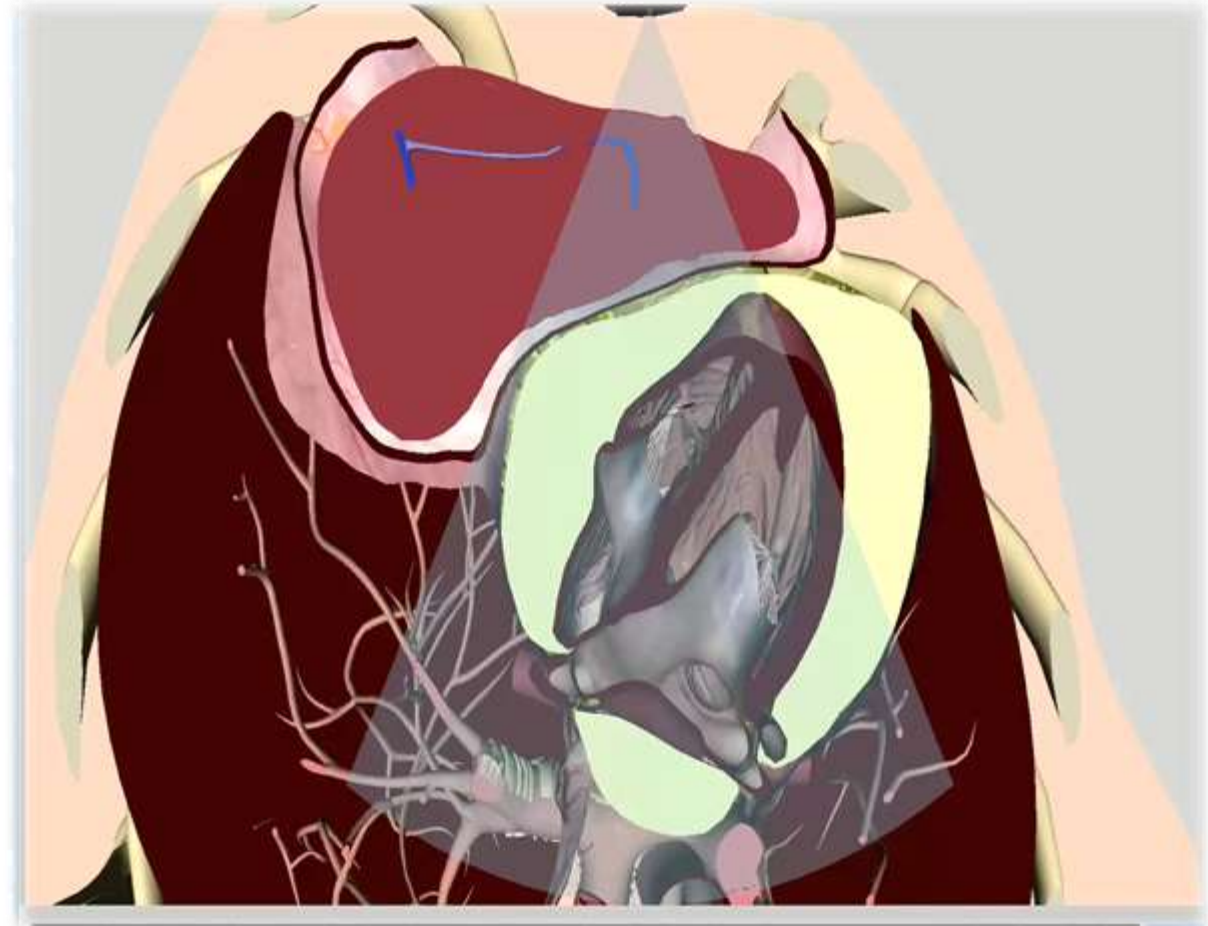| **Triage** | **Nurse led Sono-Triage (E-FAST)** | **E-FAST by Radiologist** |

AIIMS Sono-triage Scan Protocol
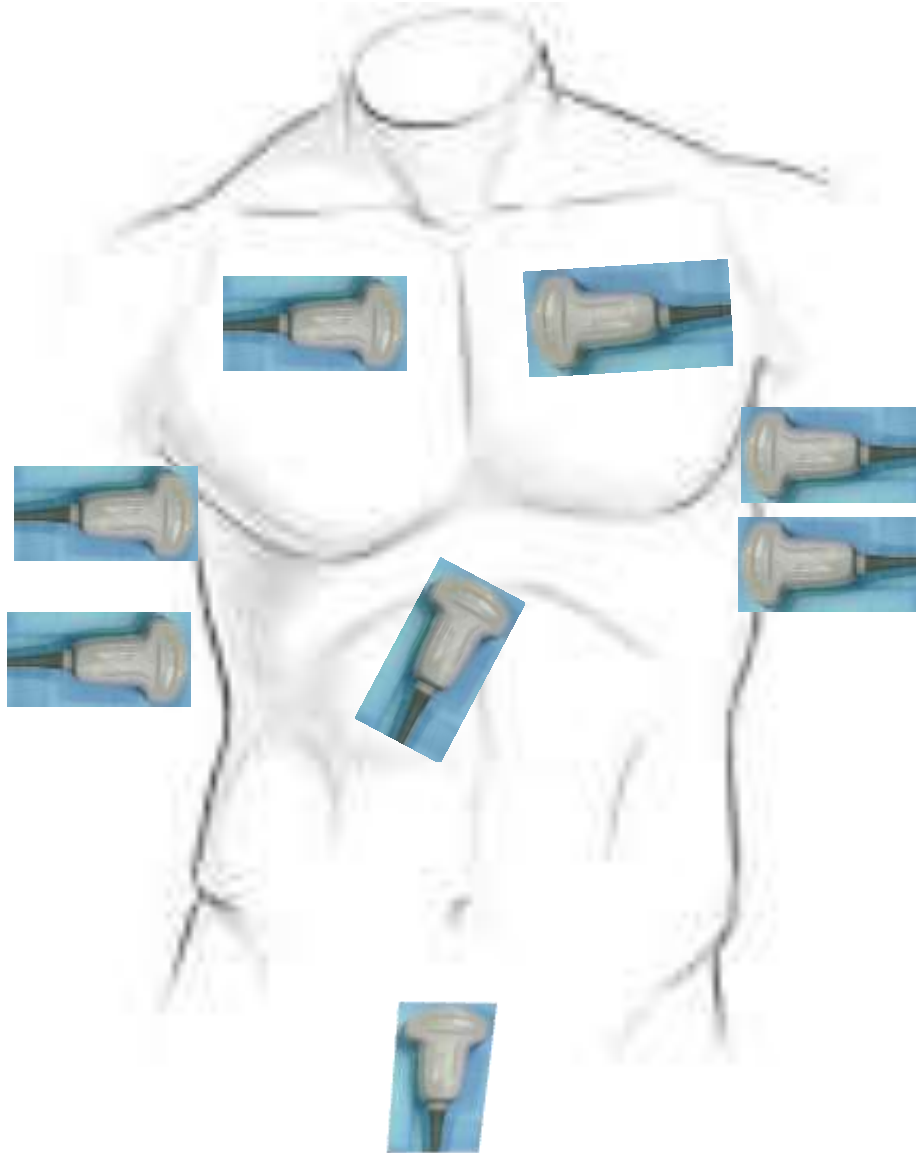
Patient Position: Supine
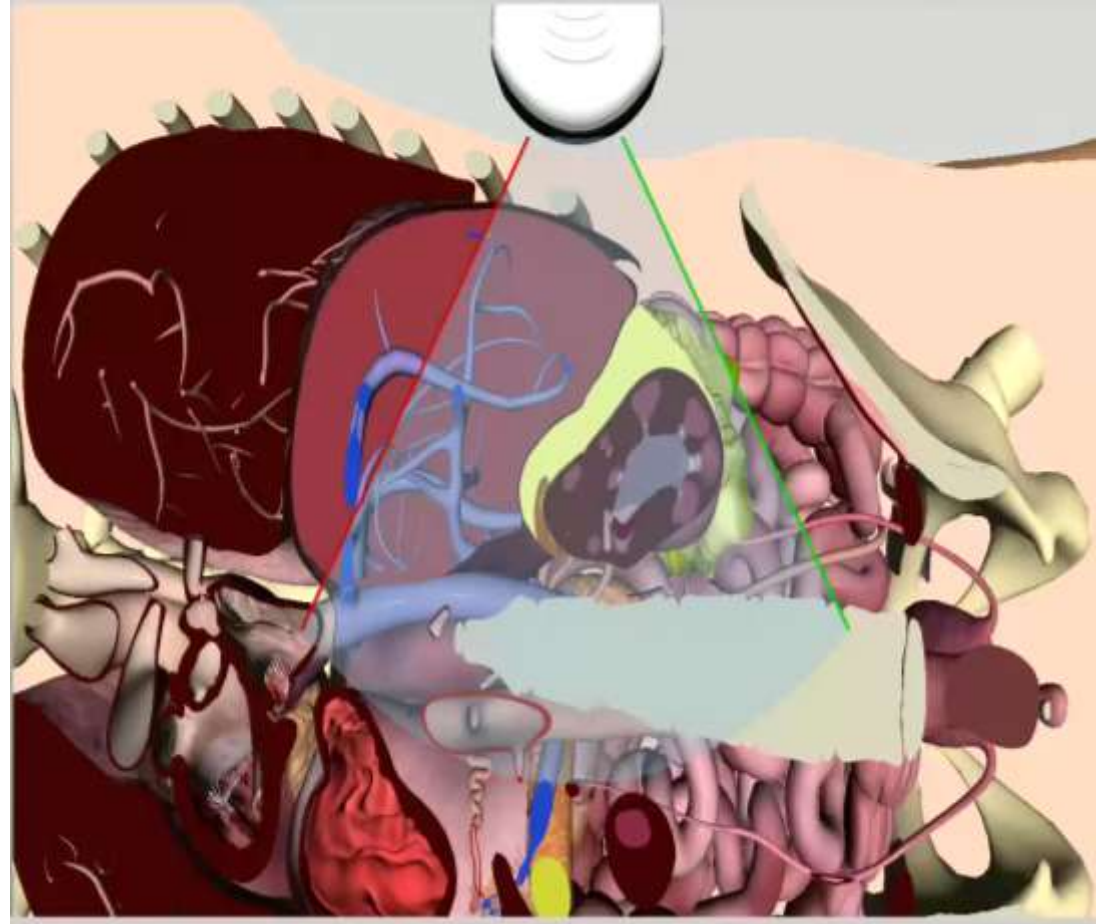**Probe: Large Convex (2-5 MHz)**
Windows scanned:

1. Sub-Xiphoid
2. RUQ
3. LUQ
4. Pelvic
5. Rt. Basal pleural window
6. Lt. Basal pleural window
7. Rt. Para-sternal
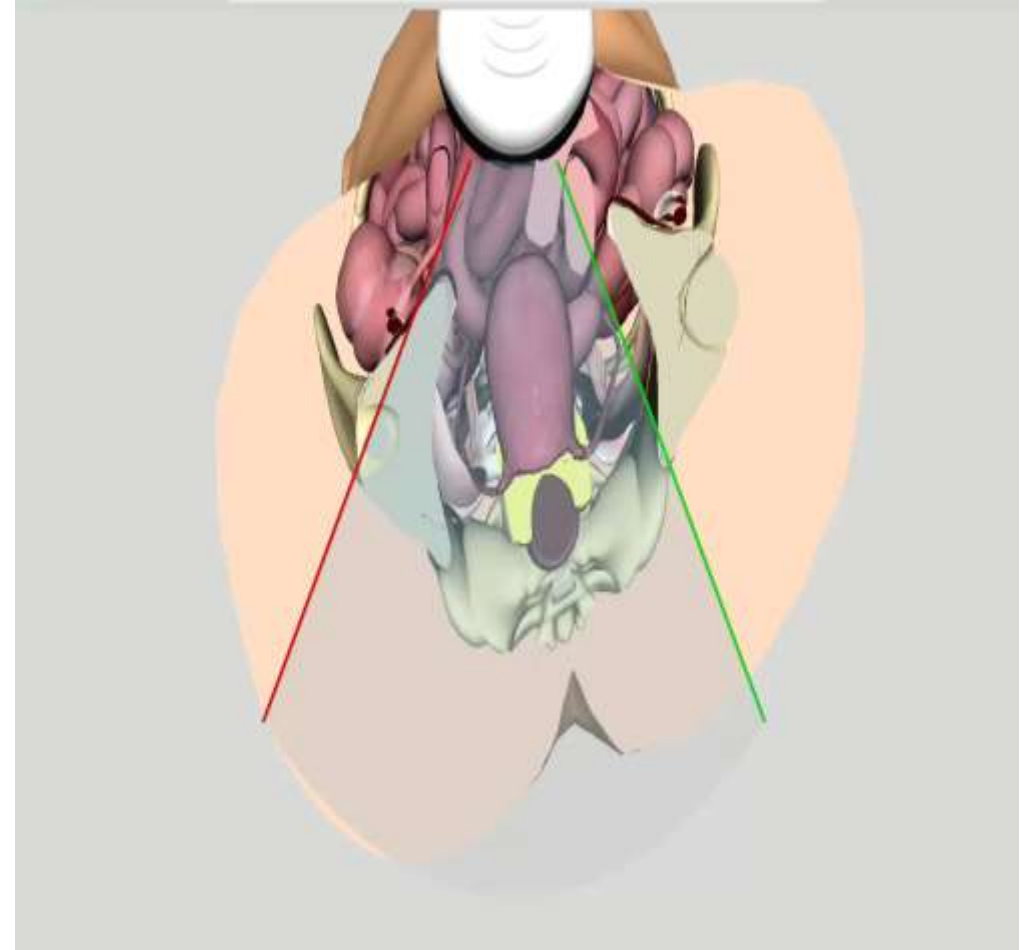8. Lt. Parasternal

E-FAST Exam – Sub-Xiphoid view

E-FAST Exam - RUQ

E-FAST Exam - LUQ

Suprapubic Transverse view

E-FAST Exam – Pleural space

E-FAST Exam – Parasternal

Normal (Sea-shore sign)

Pneumothorax (Barcode sign)
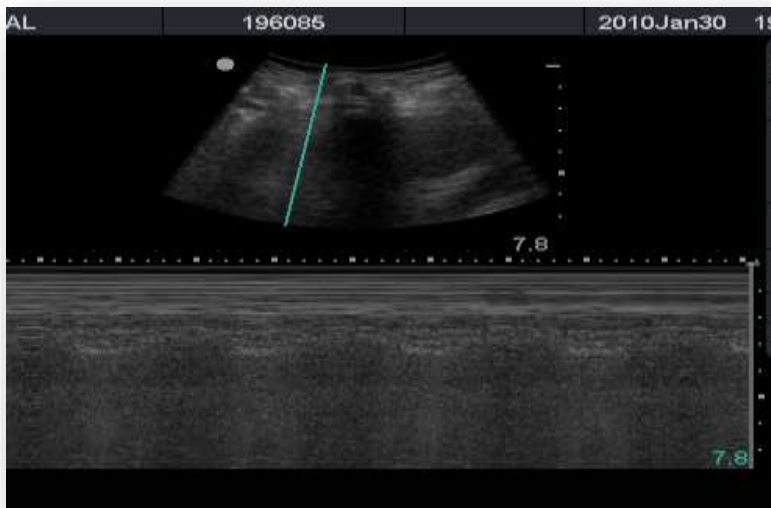
Methodology

❏ **Under-triage:**

- Those turn out to be positive in any E-FAST scan window were recorded as Sono-triage positive & event noted as under triage & were re-triage as red.

❏ **Statistical analysis:**

- Data were analyzed by SPSS version 26. Prior ethical approval was taken.

Results

Flow Chart

Total patients with Trauma
N=1609

Excluded Patient brought-in dead on arrival: n=6

N=1603

Excluded (n= 892)
Red triage: n=140 &
Green triage: n=752

N=711

Unable to recruit due to inability to perform Sonotriage: n=273

N=438

**Sono-Triage Negative
N=430**

**Sono-Triage positive
N=8**
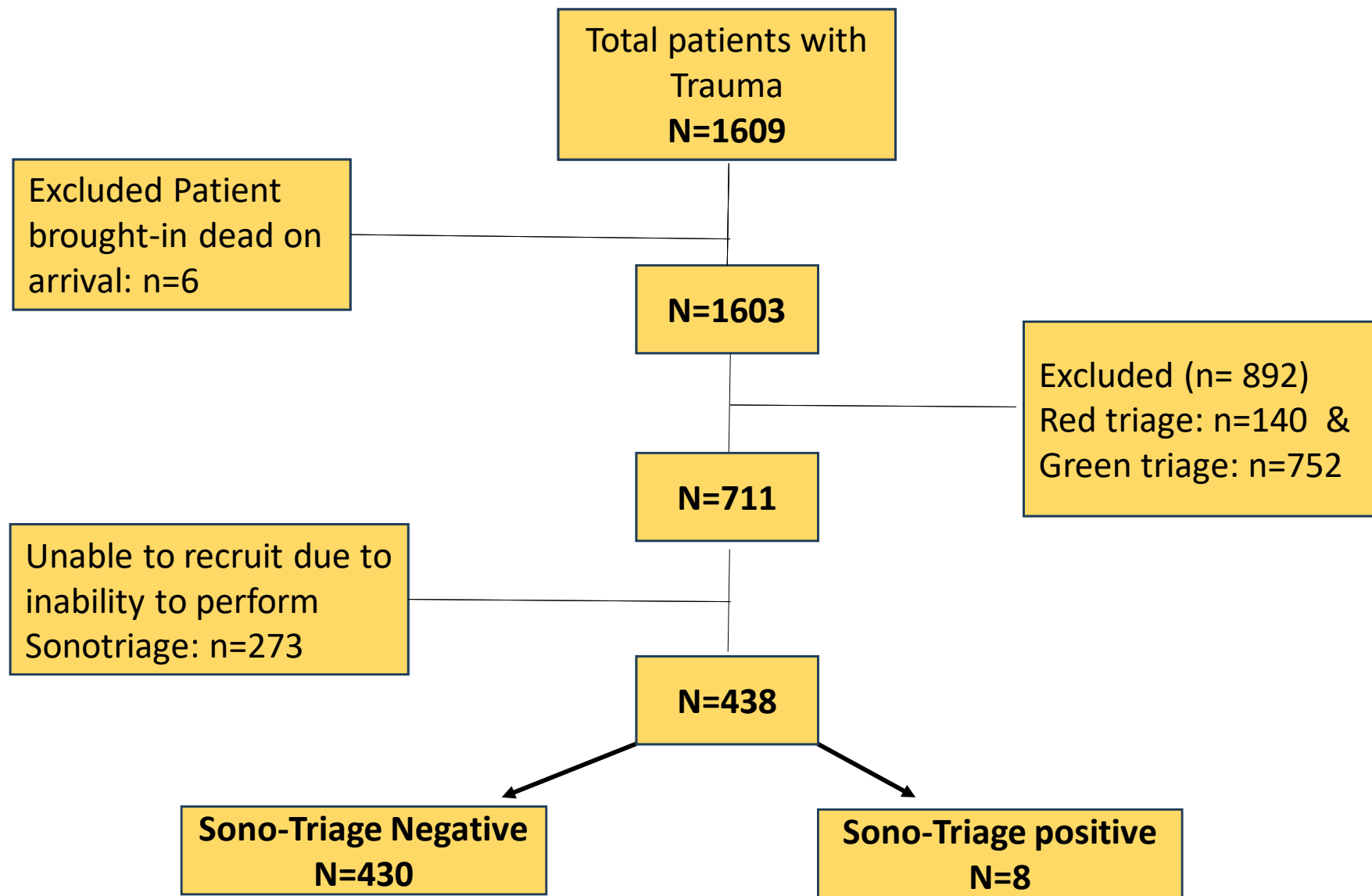
Result

Total patients Sono- triaged	27% (438/1609)	
Age group	2 months to 87 yrs	
Paediatric	61 /438	(13.9%)
Sono-triage -ve	430/438	(98.2%)
Sono-triage +ve/Under-triaged	8 /438	(1.8%)
Inter-rater agreement (nurses versus radiologists)	100% Coefficient value of kappa= 1 (p value<0.0001)	
Discharged	328/438	(74.8 %)
Admitted	32/438	(7.3%)
Absconded	78/438	(17.8%)

Sono-Triage positive patients (n=8) : Scan window wise details
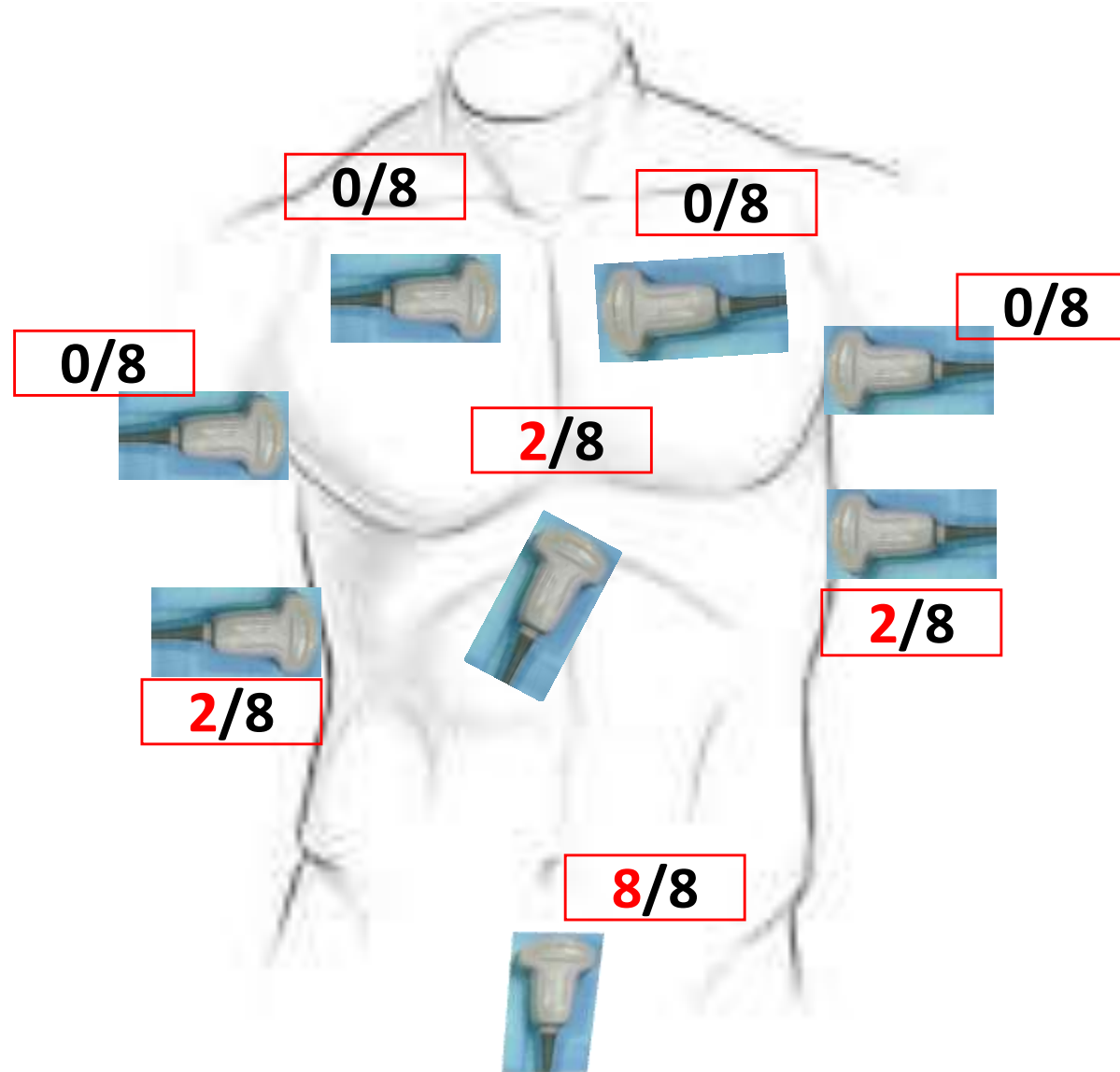
s.no	Age	Gender	Sono finding	Interpretation
1	50 Y	F	Pelvic positive	FAST positive -hemoperitoneum
2	30 Y	F	Pelvic positive	FAST positive- Hemoperitoneum
3	16 Y	F	All window positive	FAST positive- Hemoperitoneum & Pericardium
4	38 Y	M	Pelvic positive	FAST positive- hemoperitoneum
5	45 Y	M	Pelvic positive	FAST positive- hemoperitoneum
6	35 Y	M	Pelvic positive	FAST positive- hemoperitoneum
7	35 Y	M	Pelvic positive	FAST positive -hemoperitoneum
8	28 Y	M	All window positive	FAST positive - Hemoperitoneum & Pericardium

Discussion

❑ Our study showed that the nurses were able to do the E-FAST scan.

- Positivity rate 1.8%

- Sono-triage negative 98.2%.

❑**AIIMS Critical ultrasound research group: FAST study**

- AIIMS Study (2011) - Specificity 94.6%, Positive predictive & negative predictive values 81.8 & 97.2%

Matteo et.al. (2013)- Sensitivity of 84% (95% CI 72.1-92.2) & a specificity of 97.37% (95% CI 92.55-99.10)

❑**AIIMS Critical ultrasound research group: Pneumothorax study**

AIIMS Study (2011)- EN ruled out pneumothorax with 100% sensitivity (CI 92–100%) & 100% specificity (CI 39–100%)

ABSTRACTS

7th Winfocus World Congress on Ultrasound in Emergency and Critical Care, 22–27 November 2011, New Delhi, India

ACCURACY OF BEDSIDE ULTRASOUND DONE BY EMERGENCY NURSE TO RULE OUT TRAUMATIC PNEUMOTHORAX IN THE EMERGENCY DEPARTMENT

G. Adhikari, S. Bhoi, T. P. Sinha, R. K. Ramchandani, Shakuntla, V. Shoukkathali, S. Chauhan, K. Arun, Vishnu, S. Galwankar
Presenting Author: G. Adhikari
E-mail: geeta_aiims@yahoo.com

A PROSPECTIVE EVALUATION OF "FOCUSED ASSESSMENT WITH SONOGRAPHY FOR TRAUMA" DONE BY EMERGENCY NURSES AND ITS COMPARATIVE ANALYSIS WITH RADIOLOGISTS PERFORMANCE

S. Bhoi, S. Chauhan, Shakuntla, Geeta, V. Shoukkathali, Vishnu, T. P. Sinha, R. K. Ramchandani

POCUS By Non-physicians

Seth Kofi et.al study: POCUS Task shifting systematic Review

- **Performers** – Nurses, Technicians

- **Setting** – primary ,secondary & district, rural health centre, village centre

- **Scope of practice** – Abdominal, cardiac, Gynae, obstetric, lung ,Pead lung

- **Learning curve** – 6- 8 weeks of training

AIIMS Study

- Nurses

- Tertiary care

- E-FAST

- 20 scans/ 4weeks

Seth Kofi et.al; Task shifting for point of care ultrasound in primary healthcare in LMIC's-a systematic review; www.thelancet.com Vol 45 Month March, 2022

Internal validity

10 Nursing participants per course

4 Hours of didactic teaching

Hands-on learning
Ultrasound basics knobology, E-FAST

20 E-FAST scans on floor by Participants (Nurses)

E- Fast Review
By Senior Emergency Faculty before recruitment of patients

**Certification** based on participant's performance

Barriers of POCUS by Nurses in LMIC

- Limited Resource

- Poor healthcare system

- Lack of manpower

- Unstable electricity

- Language barrier

- Lack of POCUS algorithm

- Hands on training were expensive

- Poor internet connectivity

Seth Kofi et.al; Task shifting for point of care ultrasound in primary healthcare in LMIC's-a systematic review; www.thelancet.com Vol 45 Month March, 2022
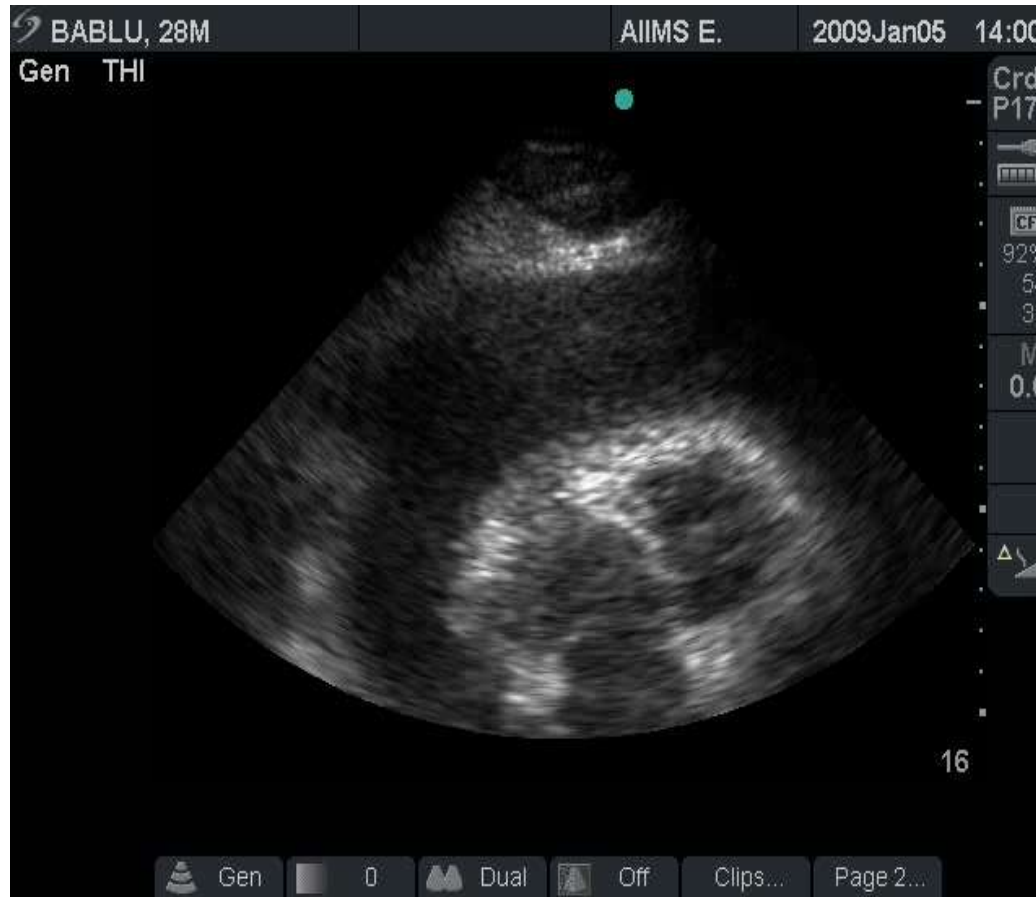
Stanislaw Peter Stawicki, MD, *Series Editor*

Portable ultrasonography in mass casualty incidents: The CAVEAT examination
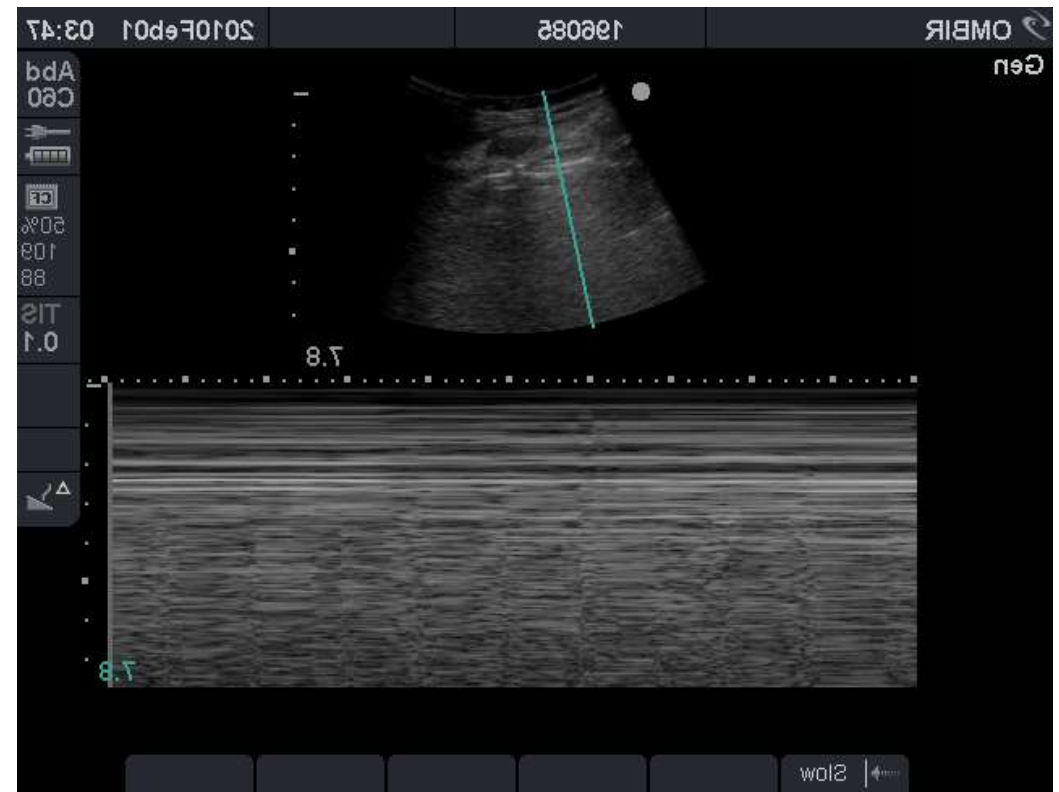
CAVEAT Examination

Abdomen

CAVEAT Examination

Vena-cava

CAVEAT Examination

Extremity Injury Secondary Triage

Stawicki SP *et al*. Portable ultrasonography for mass casualty incidents

Figure 4 Bedside sonographic appearance of a displaced femoral fracture. A correlation to plain radiography is shown. Bedside sonography provides a viable tool for quick and reliable assessment of suspected long-bone fractures. R FEMUR: Right femur; XFIRE: Cross table film.

CAVEAT EXAMINATION

The caveat of CAVEAT Protocol

Limitation:

- The CAVEAT examination will not detect most intracranial, pulmonary, retroperitoneal or pelvic injuries.

- Sonologist required

- CAVEAT protocol is yet to be established

- Feasibility of the CAVEAT protocol in Emergency & Pre-hospital is to be done

Strength of Our Study

- Good sample size
- Performer were standardized
- Sono triage was used on arrival
- Validate by Radiologist

Limitations

- Retrospective study
- Only E-FAST was used for triage protocol (does not include airway, ONSD etc.)
- Single centre
- Only Yellow triage patients
- We did not record the time taken for performing Sono triage
- Facility based triage only
- Inter-rater agreement among the nurses were not noted

Conclusion

- Sono-triage done by nurses were able to estimate the under-triage rate among yellow triage patients. The inter-rater agreement with radiologist was good.

Future Direction

- Prospective multicentric study with all triage category
- New more comprehensive, feasible algorithm need to develop
- Studies using handheld miniature machine
- Role of POCUS in secondary & field triage
- Inter-rater agreement among the nurses may be studied

References:

1. Ashkenazi et.al. "Precision of In-Hospital Triage in Mass-Casualty Incidents after Terror Attacks". Prehospital and Disaster Medicine, 21(1), 20-23. doi:10.1017/S1049023X00003277

2. Richards JR, et.al. Focused Assessment with Sonography in Trauma (FAST) in 2017: What Radiologists Can Learn. Radiology. 2017 Apr;283(1):30-48.

3. Stawicki SP et.al. Portable ultrasonography in mass casualty incidents: The CAVEAT examination. World J Orthop 2010; 1(1): 10-19 [PMID: 22474622 DOI: 10.5312/wjo.v1.i1.10]

4. Storti M et.al. Nurse-performed FAST ultrasound in the emergency department: a systematic review. Prof Inferm. 2013 Jan-Mar;66(1):5-16. Italian. doi: 10.7429/pi.2013.661005. PMID: 23591031.

5. Sztajnkrycer MD, et.al.FAST ultrasound as an adjunct to triage using the START mass casualty triage system: a preliminary descriptive system. Prehosp Emerg Care. 2006;10:96-102

THANK YOU

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