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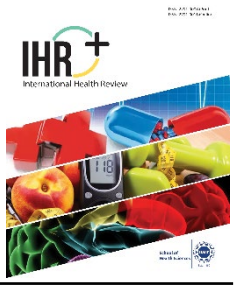

Title: **Comparative Study of Multi-detector Computed Tomography and Ultrasonography Findings in Blunt Abdominal Trauma in Tertiary Care Hospitals of Central Punjab**

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Comparative Study of Multi-detector Computed Tomography and Ultrasonography Findings in Blunt Abdominal Trauma in Tertiary Care Hospitals of Central Punjab

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ABSTRACT

Evaluating patients with blunt abdominal trauma (BAT) remains a resource-intensive area of trauma care. Blunt abdominal trauma diagnosis is challenging due to non-specific symptoms and imaging difficulties. Ultrasonography (USG) is a non-invasive imaging modality with high sensitivity value. USG always remains controversial in diagnosis of blunt abdominal injuries in comparison. The current study is based on a "comparative study design" in which information was gathered from patients at tertiary care hospitals in central Punjab. The study was conducted over a period of two months, from June 2023 to August 2023, and included a total of 78 participants. The study reveals that USG was 95.23% sensitive and 75.25% specific, while computed tomography was 98.3% sensitive and 100% specific in identifying all solid abdominal lesions. The sensitivity of USG was 90%, 93.8%, 60%, 40%, and 11% for the diagnosis of spleen, liver, kidney, pancreatic, and intestinal lesions, respectively. The sensitivity of a CT scan was 100% for detecting injuries to the spleen, liver, pancreas, and kidney, and 80% for injuries to the colon. On USG and CT, the sensitivity for mesentery detection was 0% and 2.8%, respectively. 37 patients were at high risk on the basis of BATTS score, whereas 21 patients were at low risk and remaining 20 patients were under intermediate risk. Whereas BMI underweight, overweight, obese and normal were (20.5%), (19.2%), (14.1%) and (46.2%) respectively in our study; distension, abdominal organ injury. The most sensitive and specific diagnostic tool for evaluating the abdomen is CT, which helps physician determine the best course of treatment. The damage in blunt abdominal injuries can be accurately and precisely identified by computed tomography. However, USG remains the preferred initial investigation.

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Keywords: BAT (blunt abdominal trauma), CT (computed tomography), USG (ultrasonography) BMI (basal metabolic rate)

1. INTRODUCTION

The diagnosis of blunt abdominal trauma is complex due to the vagueness of the symptoms and the difficulties in getting precise imaging, It is debatable whether USG is more sensitive and specific than CT scan in the diagnosis of blunt abdominal injuries.

Ultrasonography (USG), a non-ionizing imaging technique, has been widely used to diagnose blunt abdominal trauma, determine the presence of abdominal fluid, and find injuries to the liver, spleen, and kidneys [1]. CT scans can detect even small injuries to the organs and tissues within the abdomen, which can be missed by other diagnostic tests. CT can be performed quickly and provide cross-sectional images of the internal structures of the body, allowing for a rapid diagnosis and treatment plan.

Fast scan is a form of USG that is very sensitive to finding free intraperitoneal fluid. However, CT has evolved as the unquestioned imaging method of choice for stable trauma patients [1]. CT scans are non-invasive, meaning that they do not require any incisions or invasive procedures, reducing the risk of complications and promoting a faster recovery. The criteria for non-operative management are constantly changing and choosing the best technique has recently become a matter of contention in the management of abdominal blunt trauma [2]. CT examines the accurate imaging of internal organs and can assist with evaluating the amount of blood present in the abdomen**.** The aim of this research study is to find out the sensitivity and specificity of Ultrasound and CT and how much we rely on it, particularly in areas where CT is less accessible. Moreover, the current study aims to evaluate how imaging modalities and their diagnostic indices contribute to the assessment of BAT. A considerable improvement in trauma care has been made with the introduction of CT. The abdomen and retroperitoneum are scanned with a CT scan, which also reveals the kidney's functional state and looks for skeletal damage [3].

CT scan requires trained technicians, specialized equipment and lot of electricity to operate which can be challenge in areas of where there may be limited access to power. As a result, it can be more cost effective to use ultrasounds, which are less expensive and easier to transport [4]. Ultrasound

imaging equipment is used to investigate internal organs [5]. The instrument generates high-frequency sound waves, which are reflected by internal structures [6]. This is a rapid ultrasound procedure that is utilized to evaluate for the presence of free fluid or blood in the abdomen, which can be sign of internal bleeding or other injuries in a patient who have experienced trauma [7]. Abdominal CT for blunt abdominal trauma is typically done with intravenous contrast. During the procedure, the patient lies flat on the CT table and contrast material is injected into vein in the arm. The contrast material helps highlight the blood vessel and organs in the abdomen. The CT scanner takes multiple images in different planes of the abdomen from different angles, which are then reconstructed into detailed images of the abdominal organs. The entire CT scan procedure usually takes about 30 minutes to complete [8].

2. MATERIALS AND METHODS

During the period of June 2023 to August 2023, a total of 78 participants were included in this study, which compares the findings of multi-detector CT and Ultrasonography in patients with blunt abdominal trauma. The data is collected from patients presented in Radiology department of several hospitals in Lahore including Ghurki Trust and Teaching Hospital Lahore, Mayo Hospital, Services Hospital, and Shaikh Zayed Hospital. The patients presented with symptoms of blunt abdominal trauma,such as, abdominal pain, chest pain, abdominal tenderness and abdominal distension.

A sample of 78 patients of various age groups was selected for this study from these tertiary care hospitals in Central Punjab. The study was conducted with the approval of the ethics committee, as outlined in approval letter no. 2994/HR/GTTH.

2.1. Inclusion& Exclusion Criteria

Both male and female patients, who were hemodynamically stable patients from any age group, were included in the study. While patients with incomplete medical histories, previous burn injuries and surgical interventions, pregnant women, and inadequate imaging tools were excluded from the research study.

2.2. Study Design

The current study is based on a "comparative study design" in which information was gathered from patients at tertiary care hospitals in central

Punjab. A total of 78 patients, who met the eligibility criteria, were included in the study. For each patient, a detailed medical history was obtained, and thorough physical examinations were conducted using a patient proforma developed for this study.

2.3. Radiological Examinations

To confirm the diagnosis, imaging tests were administered to all 78 individuals. SAMSUNG HM70 EVO, TOSHIBA, AND XAIRO were used for USG/FAST scanning. Axial slices were collected during a CT scan that was both non-contrast and contrast-enhanced. Multi detector CT (MDCT) was used to perform coronal and sagittal reformatting.

2.4. Computed Tomography Technique

All MDCT examinations were carried out when the patient was supine. Non-contrast followed by contrast tests were performed using the arterial, venous, and delayed phases.

2.5. Ultrasonography Technique

Sonograms were performed on patients who were supine. A 3.5 MHz convex probe and a 7.5 MHz linear probe were used for the examinations.

Table 1. Types and Models of Transducers Used for FAST Scan

Transducer Types	Models	Frequency Range
Linear Array	L7-4	4-7 MHz
Linear Array	L15-7	7-15 MHz
Convex Array	C5-2	2-5 MHz
Convex Array	C8-5	5-8 MHz

FAST scans are used to identify free fluid in the pericardium, perihepatic space, perisplenic region, and pelvis. An examination of the lungs by pneumothorax is possible with extended FAST.

2.6. Statistical Analysis

The Statistical Package for the Social Sciences, version 23 (SPSS) was used to analyze the data. Calculations for false positive, false negative, genuine negative, and false positive were made by contrasting the USG and CT results with the results of surgery.

3. RESULTS

3.1. Relationship of Blunt Abdominal Trauma with Age

In this study, patients of all ages were included and categorized into four age groups. The 1st group included children aged 1-14 years, 2nd included youth aged 15-24 years, 3rd included adults aged 25-50 years, and 4th group included older adults aged 50-100.Among these groups, adults (25-50 years) were found to be the most prone to blunt abdominal trauma, accounting for 45.6% of the cases. Children (1-14 years) were least affected, with only 12.7% of the cases occurring in this age group.

3.2. Relationship of Blunt Abdominal Trauma with Gender and BMI

Regarding gender, blunt abdominal trauma was more prevalent in males. Of the 78 patients, about 67 were male and 11 were female, indicating a higher susceptibility to trauma in males. The percentage value of these results, about 85.7% males and 14.1% females are prone to Blunt abdominal trauma. According to BMI underweight, overweight, obese and normal were (20.5%), (19.2%), (14.1%) and (46.2%) respectively.

Table 2. Relationship Of Blunt Abdominal Trauma with Age

Age groups	Frequency	Percentage	Valid percentage	Cumulative percentage
1-14	10	12.7	12.8	12.8
15-24	18	22.8	23.1	35.9
25-50	36	45.6	46.2	82.1
51-100	14	17.7	17.9	100
Total	78	98.7	100	

The frequent prevalent cause of BAT is blunt injury. Traffic accidents accounting for53.8% of the cases, followed by fall from height 21.8%, assault17.9 % and bull horn injury6.4%among patients.

Abdominal pain was reported by 96.2% of the patients whose symptoms were examined. This was followed by abdominal distension (41.0%), chest discomfort (53.8%), and stomach soreness (76.9%).

Table 3. Blunt Abdominal Trauma Causes

	Frequency	Percentage	Valid percentage	Cumulative percentage
RTA	42	53.8	53.8	53.8
Fall from height	17	21.8	21.8	75.6
Assault	14	17.9	17.9	93.6
Bull horn injury	5	6.4	6.4	100
Totally	78	100	100	

The spleen was wounded most frequently. (23.1%), the liver (19.2%), kidney (14.1%) and pancreas (6.4%) the least injured organs identified was pancreas 37.2 % patients came without any solid organ injury.

The most frequently soft tissue injury mesentery was (11.5%), the diaphragm (3.8%), and Omentum was (5.4%) the least soft tissue injured was the diaphragm.

Abdominal Injury in Hollow Viscus: The most frequently hollow viscus injury stomach was (12.8%), the S/L intestine (15.4%), and Rectum was (1.3%), whereas (70.5%) cases presented without any hollow viscus injury out of 78 cases. Whereas63% having (+) Fast Scan when they were come to radiology department.

3.3. Sensitivity and Specificity

Sensitivity and specificity of USG were 95.23% and 75%, respectively. Moreover, CT was 98.3% sensitive and 100% specific in identifying all solid damage. USG sensitivity for detecting spleen, liver, kidney, pancreatic, and intestinal injuries was 90%, 93.8%, 60%, 40%, and 11%, respectively. CT has a 100% sensitivity for detecting liver, spleen, kidney, and pancreatic injuries, and an 80% sensitivity for detecting colon injuries. The sensitivity for detecting mesentery on USG was 0% and 2.8% on CT.

Table 4. Sensitivity and Specificity of USG

Organ	Sensitivity	Specificity	Type I Error	Type II Error
Liver	80%	85%	15%	20%
Spleen	65%	79%	21%	35%
Kidney	75%	88%	12%	25%
Intestine	70%	82%	18%	30%

Table 5. Sensitivity and Specificity of CT

Organ	Sensitivity	Specificity	Type I Error	Type II Error
Liver	85%	90%	10%	15%
Spleen	70%	83%	17%	30%
Kidney	80%	85%	15%	20%
Intestine	78%	87%	13%	22%

3.4. Relationship of Blunt Abdominal Trauma with Management

The remaining 48 patients needed surgical care, whereas 30 of the patients were handled conservatively. The patient's clinical and hemodynamic stability will determine the course of treatment. However, all 100% of the CT findings for damage to the liver, kidneys, spleen, pancreas were positive. Every case of statistically significant (p <0.001) inter-rater agreement between USG and CT results was discovered.

3.5. Relationship of Blunt Abdominal Trauma with BATTS

According to our data 37 patients were at high risk on the basis of BATTS score whereas 21 patients were at low risk and remaining 20 patients were under intermediate risk.15 of the 78 patients had pelvic fractures.

Table 6. Relationship of Blunt Abdominal Trauma with BATTS

	Frequency	Percentage	Valid percentage	Cumulative percentage
Low Risk	21	26.9	26.9	26.9
Intermediate Risk	20	25.6	25.6	52.6
High Risk	37	47.4	47.4	100
Total	78	100	100	

4. DISCUSSION

The number of abdominal injuries is increasing daily as a result of a growth in the number of vehicles on the road, which has led to moreroadside accidents. It is the leading cause of death, hospitalization, and long-term disability in those under the age of 40. The demographics of the patients in this study matched those in the research by Maske and Deshmukh [9], Kulkarni et al. [10], Nnamonu MI et al. [11]. They also reported that the

majority of patients ranged in age from 21 to 40, with a predominance of male patients. USG sensitivity and specificity were 95.23% and 75%, respectively, but CT was 98.3% sensitive and 100% specific in identifying all solid injuries, comparable to previous research [10]. USG sensitivity for detecting spleen, liver, kidney, pancreatic, and intestinal injuries was 90%, 93.8%, 60%, 40%, and 11%, respectively. CT has a 100% sensitivity for detecting liver, spleen, kidney, and pancreatic injuries, and an 80% sensitivity for detecting colon injuries. The sensitivity for detecting mesentery on USG was 0% and 2.8% on CT.

Mohsin et al. [8] included less USG sensitivity owing to intestinal gas, surgical emphysema, and empty bladder. Blunt pancreatic injuries are comparatively uncommon, accounting for just 0.25% of all trauma cases, 2.4% of abdominal traumas, and 4.3% of fatality rates [12]. They are frequently caused by acceleration-deceleration forces and direct compression in the upper abdomen [13]. While CT was more accurate, the study noted that US provided a rapid initial assessment, allowing for immediate identification of free fluid or hemoperitoneum. This can be particularly valuable in emergency settings where time is critical [14]. The complementary roles of US and CT in the evaluation of blunt abdominal trauma, suggesting that both modalities should be utilized in conjunction to enhance diagnostic accuracy and patient care [15]. Different imaging modalities influence management decisions in patients with blunt abdominal trauma. The authors analyze the roles of computed tomography and ultrasonography (US) in clinical decision-making processes, evaluating their effects on treatment strategies, surgical interventions, and patient outcomes [16].

US presents a cost-effective alternative, particularly in resource-limited settings. The review concludes that a strategic approach to selecting imaging modalities based on clinical context and economic considerations can improve both patient care and resource allocation in trauma management [17]. The paper highlights the versatility of ultrasound, including its ability to be performed at the bedside, which enhances rapid decision-making in acute care. As a result, we conclude that USG/FAST is a noninvasive and easily accessible technique for selecting a patient for CT and detecting free fluid in a trauma patient. Rehash USG can now and then be useful for stable patients on the off chance that discoveries were at first out. CT is the basic decision-making tool for stable patients. All Ultrasound

scans are performed by highly trained Medical Imaging Technologists and Radiologists as per criteria by PMDC.

4.1. Conclusion

The most sensitive and specific diagnostic tool for evaluating the abdomen is CT, which helps physician determine the best course of treatment. However, in underdeveloped countries where CT scans may not be widely available, the research findings suggest that ultrasound (USG) can be a reliable alternative. With a sensitivity of 95.23% and a specificity of 75%, USG proves to be a valuable diagnostic tool when CT is not accessible.

CONFLICT OF INTEREST

The authors of the manuscript have no financial or non-financial conflict of interest in the subject matter or materials discussed in this manuscript.

DATA AVAILABILITY STATEMENT

The data associated with this study will be provided by the corresponding author upon request.

FUNDING DETAILS

No funding has been received for this research.

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