



Original Research Article

A comparative study between emergency department provisional diagnoses and final discharge diagnoses in tertiary and quaternary health centers of India

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ABSTRACT

Background: An Emergency Department (ED), or the Emergency Room (ER), is a specialized patient care facility in tertiary and quaternary health care centers dedicated to Emergency Medicine. The main function of which, is to take care of patients with immediate and emergent health issues. In view of limited literature on Emergency Medicine in India, a comparative study of the admission and discharge diagnoses was performed, as a baseline for future reference in continuous quality improvement.

Aim: A scientific endeavor dedicated to undertake a comparative study between the emergency department provisional diagnosis and the final inpatient discharge diagnosis, thus determining the diagnostic accuracy of the emergency medicine department in large health care centers of India.

Material and Methods: A total of 3000 patients visiting the emergency department were considered and a comparative study was performed between the emergency department diagnoses and the final discharge diagnoses of these patients after admission to respective specialties.

Result: In 81% cases the emergency department diagnoses was found to be concordant with the discharge diagnoses of the patients under study, and the concordance was found to be statistically significant.

Conclusion: According to our study, the initial diagnoses made by emergency department physicians were mostly consistent with the final diagnoses. The significance of a correct diagnosis in the emergency department is far reaching. A correct diagnosis of the disease in the emergency enables prompt implementation of desired management protocols facilitating better patient outcomes and favorable disease prognosis. However, our study also highlights the need for further improvement in the diagnostic protocols in the emergency department.

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1. Introduction

The Emergency Room (ER) of a hospital is responsible for immediate care of patients with emergent health concerns. The ER in large tertiary and quaternary health care centers are managed by physicians with specialization in Emergency Medicine. The ER is the point of first contact in any hospital for patients with emergent health issues.

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This no doubt, makes it one of the most vital components of patient care. The Emergency Medicine specialist in the ER are responsible for reducing mortality and morbidity of patients as they make quick provisional diagnoses and manage them accordingly. Emergency Medicine as a specialty is still in its nascent state but is a rapidly evolving field in India. Its expertise is concentrated mainly in tertiary care multi-specialty hospitals of most metropolitan cities such as Delhi, Hyderabad, Bangalore, Chennai, etc. as

opposed to Casualty departments seen in smaller hospitals.

The first privatized Emergency Department (ED), was based on the American Community Hospital Emergency system, was established at the Sundaram Medical Foundation, Chennai, with help and support from emergency physicians from the Long Island Jewish Medical Centre, USA, in the late 1990. Emergency Medicine, which deals with critically ill and injured patients in its daily practice where diagnostic accuracy may mean life or death.¹ Studies in India regarding the comparison of admission diagnosis in an ED and final outcome diagnosis are limited.² There have been few local studies comparing ED diagnoses with the diagnoses obtained from the department of final admission viz. general medicine, cardiology, neurology, general surgery, CCU, MICU etc. The following study hopes to draw a comparison between provisional ER diagnoses at admission versus the diagnosis at in-patient discharge from the hospital irrespective of specific system involvement. The aim of this study is to provide a comparison between the admission and discharge, which subsequently can evaluate the existing performance of the emergency department, and also serve as a future reference in continuous quality improvement. The present study was undertaken at a tertiary care center, enabled with an established department of emergency medicine, with the availability of trained emergency medicine specialists and the necessary diagnostic equipment's required to provide the best possible acute care service to patients in the ER.³

2. Aims and Objectives

The primary aim of this scientific endeavor was to undertake a comparative study between the emergency department provisional diagnosis and the final inpatient discharge diagnosis, thus determining the diagnostic accuracy of the emergency medicine department in large tertiary and quaternary health care centers of India. This study also highlights areas with potential for further improvement which when implemented can provide a greater diagnostic accuracy in the Emergency room.

3. Materials and Methods

3.1. Study area

The study was conducted in tertiary and quaternary care centers with an established ER. In these medical centers, patient care is provided by a dedicated group of Emergency medicine physicians, senior residents and consultants.

3.2. Inclusion criteria

All patients evaluated in the adult emergency department and subsequently admitted to the hospital, above the age of 16 years.

3.3. Exclusion criteria's

1. Previously diagnosed oncology patients presenting with oncological emergencies.
2. Patients admitted for more than 10 days
3. Patients requiring immediate surgical intervention and being shifted to the operation room from the emergency department.
4. Diagnosed patients from OPD/other hospitals referred to ER for stabilization & subsequent admission.

3.4. Study design

A prospective, observational study of Presumptive Diagnoses (PD) made in the ER by EM physicians and the final diagnoses in the wards made by the particular specialty.

3.5. Study period

The study was carried out over a period of 3 years from 01/10/2017 to 30/09/2020.

3.6. Sample size

Considering a confidence level of 95% and confidence interval of 1.8 the number of patients in our study to achieve statistical significance was 3000.

3.7. Statistical analysis

Qualitative data was presented with the help of frequency and percentage table. While the association among study group was assessed with the help of Chi-Square test and Independent t-test. A p-value less than 0.05 was taken as significant level. MS Excel, SPSS ver. 20 was used for statistical analysis.

3.8. Methodology

All the patients were admitted to the ER and these patients were diagnosed by EM physicians during the study period beginning from the triage. Correspondence of ER diagnoses and the final discharge diagnoses in different age group, gender, specialties, specific diagnosis in systems were involved. Based on the initial assessment and investigations a provisional diagnosis was made in the Emergency Department & depending on the severity of the case & requirement for further workup and care, the patients were admitted. Patients were admitted under the required specialty depending on the nature of the illness. Within limited time frame and on the basis of accuracy of the basic investigations the provisional diagnoses made by EM physicians were analyzed, opposed to the final discharge diagnoses subsequent to the thorough in-hospital evaluation. A Matched diagnosis was defined as the ER diagnosis is the same as the final discharge diagnosis. An Unmatched

diagnosis was defined as an ER diagnosis missing the system, organ, and pathology altogether. Blanket diagnoses such as 'chest pain for evaluation', 'acute febrile illness' or 'RTA with head injury', 'giddiness' etc. were also considered as Matched diagnoses.

Ethical permit for this scientific effort was duly obtained from the institutional ethical committees in which the study was undertaken

4. Observations & Results

4.1. Assessment of the epidemiological parameters obtained from the study

Distribution of patients according to Age: The age of the subjects varied from 16 years to 102 years (mean=49, median=52). The subjects were divided into 2 groups i.e. >16-64 years and >65 years. Majority of the patients (n=260,82%) are in the age group of >16-64 years followed by (n=540,18%) in the age group of ≥ 65 years. (Table 1)

Table 1: Distribution of patients according to Age

Age (years)	N	%
>16-64	2460	82%
≥ 65	540	18%
Total	3000	100%

Distribution of patients according to Gender: The number of male patients (n=1770,59%) is significantly fewer male patients while female patients constituted (n=1230,41%) of the study group. The male: female ratio is= 1770: 1230 i.e. 1.43: 1. (Table 2)

Table 2: Distribution of patients according to Sex

Gender	N	%
Male	1770	59%
Female	1230	41%
Total	3000	100%

4.2. Assessment of study specific findings

Distribution of patients according to department of final admission: The distribution of patients according to departments of admission is characterized in Table 3. Most of the patients were from the Department of Internal Medicine (10.6%) followed by the Department of MICU (9.6%) and Department of General Surgery (8.7%). (Table 3)

Diagnostic Accuracy of Emergency Department Diagnosis: A comparison of ER physicians' diagnoses with the final inpatient discharge diagnoses was performed in this study. (Table 4). It was found that 81% cases were accurately (matched) diagnosed during emergency department admission while there was an unmatched diagnosis in 19% cases. There was no significant difference

Table 3: Distribution of patients according to department of final admission from the ER:

Department	N	%
Internal Medicine	317	10.6%
MICU	287	9.6%
General Surgery	260	8.7%
Orthopaedics	207	6.9%
Respiratory Medicine & Pulmonology	204	6.8%
Plastic Surgery	195	6.5%
Neurological Surgery	167	5.6%
CCU	156	5.2%
Gastroenterology	152	5.1%
Gastroenterology Surgical	149	4.9%
Nephrology	116	3.9%
Urology	115	3.8%
Cardiology	112	3.7%
Neurology	92	3.1%
Spine Care	80	2.7%
OBG	81	2.7%
Diabetes and Endocrinology	79	2.6%
Vascular Surgery	69	2.3%
ENT	60	2%
CTVS	49	1.6%
Rheumatology	27	0.9%
Ophthalmology	26	0.8%
Total	3000	100%

in diagnostic accuracy of emergency department diagnosis as compared to final inpatient discharge diagnoses (p>0.05). (Table 4)

Table 4: Diagnostic Accuracy of Emergency Department Diagnosis

Diagnosis	N	%	p Value	95% CI
Matched Diagnosis	2430	81%	p>0.05	2.01-3.69
Unmatched Diagnosis	570	19%		
Total	3000	100%		

Chi-Square test, p = 0.09

Association of Age and Diagnostic Accuracy of Emergency Department Diagnosis: It was observed that more errors in diagnoses were seen in the age group of ≥ 65 years (n=250; 46.3%) as compared to >16-64 years (n=2460; 13%). (Table 5)

Table 5: Association of Age and Diagnostic Accuracy of Emergency Department Diagnosis

Diagnostic Accuracy	Age (years)		Total
	>16-64	≥ 65	
Matched Diagnosis	2140	290	2430
Unmatched Diagnosis	320	250	570
Total	2460	540	3000

Association of Gender and Diagnostic Accuracy of Emergency Department Diagnosis: It was observed that more errors in diagnoses were seen female patients (n=310; 25.2%) as compared to male patients (n=260; 14.7%). (Table 6)

Table 6: Association of Gender and Diagnostic Accuracy of Emergency Department Diagnosis

Diagnostic Accuracy	Gender		Total
	Male	Female	
Matched Diagnosis	1510	920	2430
Unmatched Diagnosis	260	310	570
Total	1770	1230	3000

Association of Department of admission and Diagnostic Accuracy of Emergency Department Diagnosis: It was observed that most errors in diagnoses were seen in the patients admitted to the department of Gastroenterology (n=152;40%) followed by those admitted to Department of Urology (n=115; 23.47%). The departments having the least unmatched diagnoses were CCU (n=156,9.61%), Internal medicine (n=317;10.09%), Endocrinology (n=79;13.92%) followed by CTVS (n=49,14.28%). (Table 7)

Table 7: Association of department of final admission and diagnostic accuracy of emergency department diagnosis

Department	Diagnostic Accuracy		Total
	Matched	Unmatched	
OBG	66	15	81
Urology	88	27	115
General Surgery	206	54	260
ENT	50	10	60
Gastroenterology Surgical	119	30	149
Gastroenterology	91	61	152
Respiratory	163	41	204
Medicine & Pulmonology			
Internal Medicine	285	32	317
Neurological	134	33	167
Surgery			
Neurology	75	17	92
Cardiology	90	22	112
MICU	236	51	287
CCU	141	15	156
Nephrology	92	24	116
Orthopedics	168	39	207
CTVS	42	7	49
Rheumatology	23	4	27
Ophthalmology	21	5	26
Spine Care	66	14	80
Diabetes and Endocrinology	68	11	79
Plastic Surgery	167	28	195
Vascular Surgery	57	12	69
Total	2430	570	3000

5. Discussion and Review of Literature

In most large hospitals equipped with Department of Emergency Medicine the ER is located in the ground floor, with its own entry and exit points. The very first step of patient management in the ER is the assessment of priority on the basis of clinical status of the patient, which is known as Triage. The Triage includes brief clinical assessment of the patient while examining their vital signs. The process of Triage concludes with the determination of a "chief complaint" (e.g. chest pain, abdominal pain, difficulty breathing, etc.). Most Emergency Departments have a dedicated area for this process to take place and may have staff dedicated to performing nothing but a triage role.⁴ According to the patient's clinical status and severity the triage zone is divided into, Resus, Zone A, Zone B, and Zone C.⁵

The Emergency department of a hospital encounters clinically unstable patients. In which case, the emergent management of these patients become necessary. During situations like these in the emergency department the emergency medicine specialist has little time to devote in ascertaining the cause behind the acute life threatening clinical presentations. Management precedes diagnosis, to avoid further destabilization and mortality. This approach is the main thrust of emergency room medicine.⁶

A prospective observational study involving 3000 patients attending the ER for emergent medical consultation in tertiary and quaternary hospitals of India. During the study a comparison between the provisional diagnoses of the ER and the final inpatient discharge diagnoses was undertaken to determine the diagnostic accuracy of the emergency department. Of all the admission diagnoses made provisionally in the ER, 81% were found to be a complete match with the final inpatient discharge diagnoses, while 19% were an incomplete match. There have been only a few similar studies in India and internationally. The degree of specificity and accuracy achieved in these studies has been satisfactory as a whole. Chiu et al. in their pioneer study reported that while comparing provisional diagnoses made in the ER, 71.4% diagnoses fully or partially matched the final discharge diagnoses. The accuracy of diagnosis was statistically better in traumatic cases, the male sex and young adults.⁷

Goh et al. in their study reported achieving a high degree of accuracy of diagnosis for surgical disciplines (82.9% for general surgery, and 95.8% for orthopaedic surgery), and an acceptable degree of accuracy (77.6%) for general medicine.⁸

Missed diagnoses in the cardiac specialty are almost always fatal and should be minimized. A study conducted by Pope et al on 10,689 patients with chest pain in the ER, 8% had acute myocardial infarction, 9% had unstable angina, 6% had stable angina, 21% had other cardiac problems, and 55% had non-cardiac issues. Of the 889

patients with a confirmatory diagnosis of acute myocardial infarction, 19 (2.1%) were mistakenly discharged from the emergency department (95 percent confidence interval, 1.1 to 3.1%); similarly, 966 patients with unstable angina, 22 (2.3%) were mistakenly discharged (95 percent confidence interval, 1.3 to 3.2%).⁹ In our study, cardiac cases were 2.63% (n=15 patients) of all missed diagnoses (n=570/3000 patients: 19%) but in contrast, none of these cases were discharged; they were admitted for evaluation of chest pain. On investigation the initial ECG reports and cardiac biomarkers of these patients were normal. These patients were admitted for sustained monitoring of ECG and cardiac biomarkers.

This study achieved nearly 90% diagnostic accuracy in internal medicine specialty. Some examples which could not be diagnosed are as follows-

1. Fever and weakness for past 4 weeks under investigation—1 patient during follow up and further serological investigations revealed to have brucellosis as the final diagnosis.
2. Severe acute abdominal pain for investigation — a single patient was diagnosed with acute intermittent porphyria, after ruling out other conditions with evidence elevated porphobilinogen in blood and urine.
3. Severe anaemia for investigation — due to menorrhagia
4. Hyperventilation with syncope —single female patient was found to have UTI, and Vitamin B12 deficiency.
5. Patient c/o epigastric pain, ER diagnosis of musculoskeletal pain under query— for 2 such patients the diagnosis was confirmed to be pleurisy.
6. Acute gastroenteritis—1 patient later on further investigation was found to have jejuno-jejunal intussusception, proper h/o of the patient was not obtained, especially recurrent vomiting.

From the results it was evident that most of the cases were diagnosed accurately, rest which could not be diagnosed, actually require more extensive workup and specialized opinion before a final diagnose can be reached.

Nowadays with increasing proportion of respiratory illnesses presenting to the ER, it was found that nearly 90% of cases of community-acquired cases of pneumonia could not be diagnosed in the ED. Chest X rays are the main mode of ER screening in our study.¹⁰ More training in the interpretation of X-rays may also help to improve the accuracy.

Among the surgical cases, the diagnostic accuracy achieved almost equal to 80%. A similar study was done by S H Goh also had surgical cases the diagnostic accuracy of 82%. Majority of the diagnoses made were straightforward or clear-cut such as — acute appendicitis, breast abscess, perianal abscess, haemorrhoids, subacute intestinal obstruction, anal fissure, fistula in anorectal

prolapse.

Neurological emergencies are one of the common presentations seen in every ER. Studies performed in Ohio, the USA have shown that the diagnostic accuracy in conditions such as intracerebral haemorrhage, subarachnoid haemorrhage, ischemic stroke and transient ischemic attacks is as high as 98%. Similarly, our study concluded that stroke from CVA are common neurological emergencies. In which case a 95% diagnostic accuracy was achieved in patients presenting with all kinds of strokes, including thalamic, putamen, CVT, SDH, and EDH, etc.¹¹ It was further concluded from this study that the median time from stroke onset to time of arrival to the ER was almost 6 hours, which exceed the thrombolytic window period of 3 hours. Most patients who arrived at the ER within 3 hours had used emergency medical services immediately with symptom onset.¹² As stroke patients almost always arrive late to the ED, it is important for the ER physicians and EMS personnel to make an accurate diagnosis so that imaging can be expedited and management can be initiated. In a Canadian study of 1507 patients with subarachnoid haemorrhage (SAH), 5.4% had a missed diagnosis, i.e., 1 in 20 patients,¹³ while another study including 872 patients presenting to an ED in Pennsylvania, USA, showed that only 11 patients (1.2%) with headaches had serious neurological conditions while the majority were distributed into benign conditions such as generalized infections, migraines, hypertensive and tension headaches.¹⁴ In this study, 3% of all missed diagnoses were neurological cases (n=17/570). There were 26 patients (20 males, 6 females, average age 36.2 years) with Seizures. These patients either had primary onset or breakthrough seizures.

In case of ENT related emergencies, the diagnostic accuracy achieved is nearly 84%, the common cases encountered were - epistaxis, acute tonsillitis, and CSOM. The undiagnosed cases included 5 patients with an ED diagnosis of BPPV under evaluation, later they were diagnosed with vestibular neuronitis, further necessitates the importance of additional workup and expertise of the concerned department which was not possible in the ER.

In the remaining specialties, i.e. CTVS (blunt chest trauma, pneumothorax, haemothorax, cardiac tamponade), general surgery (blunt abdominal trauma, chest, splenic rupture, stab injury, intestinal perforation), orthopaedics (all types of fracture as evident in radiological examination), MICU (all polytrauma unstable patients after operation went to MICU), neurosurgery (bleeding, contusion), spine care (herniation of disc, prolapsed disc, wedge compression) have 100% diagnostic accuracy in the ER.

Age of the patient plays a major role in diagnostic accuracy in the ER. In our study the highest accuracy was attained in the middle age group between 16 to 64 years. The geriatric population requires more attention in the ER as most of their symptoms are misleading or blunted or

are often associated with multiple co-morbidities. In our study, 43.85% of geriatric patients (n=250/570) above 65 years of age had an unmatched diagnosis, a similar finding was obtained in a retrospective study of 1863 non-elderly patients (less than 65 years of age) and 428 elderly patients presenting to ER in a university hospital in the USA, demonstrating a sensitivity/ specificity of the ER diagnosis as 86% for the non-elderly and 68% for the elderly.¹⁵

Considering various differential diagnoses before ascertaining a provisional diagnosis is an important way to improve diagnostic accuracy in ER.¹⁶

Basic investigations like X-ray, urinalysis, electrocardiography and blood tests do not essentially improve the diagnostic accuracy in the ER. However, in order to improve the diagnostic accuracy, history taking and physical examination deserves special mention, as being thorough in both of these has been found to improve diagnostic accuracy significantly. Furthermore, making it essential for doctors working in ER to master the skill and art in performing history taking and physical examination in an efficient manner.

The use of the observation ward particularly for patients with diagnostic uncertainties in the ER may also help improve the accuracy of ER diagnosis. Observation wards are particularly useful for disease conditions that have variable and subtle presentations e.g., suspected acute appendicitis.¹⁷

6. Conclusion

According to our study, the results thus obtained concludes that the presumptive/initial diagnoses made by the ER physicians were mostly consistent with the final diagnoses made by the concerned specialty doctors. This leads to the accurate choice of treatment in the ER which is very important in cases where a prompt initiation of treatment has a vital effect on the prognosis and outcome. From this study it is evident that there is a definitive need for improvement of the ER diagnostic accuracy among the geriatric population. The significance of adequate history taking and a thorough clinical evaluation are probably the most important diagnostic tools to reach a correct diagnosis in the ER

7. Conflict of Interest

The authors declare that there is no conflict of interest.

8. Source of Funding

None.

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