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Original Research Article

Cross sectional observational study to assess the knowledge of drugs utilized in emergency medical conditions amongst medical interns and residents in tertiary care teaching hospital

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ABSTRACT

Background: Medical interns and residents are future medical professionals and as first-line responders, they may confront any type of emergency. Knowledge of pharmacotherapeutics (PTs) is the backbone of emergency care. Therefore, this study is designed to assess PTs' knowledge and identify the lacunae in handling various medical emergencies among medical interns and residents.

Methods: This was a cross-sectional, observational, questionnaire-based study. A self-structured questionnaire containing 30 close-ended questions, assessing the knowledge of drugs utilized in various medical emergency conditions was prepared and circulated in the form of a Google form. A credit score of "1" was given for each correct response. Grading of knowledge was done as "poor" ($\leq 50\%$), "average" ($>50-70\%$), and "adequate" ($>70-100\%$). The student's unpaired t-test was used to analyse the data.

Results: A total of 282 candidates responded, with 148 (52.48 %) interns and 134 (47.52%) residents. Participants had the least knowledge of PTs for anaphylactic shock. Participants' knowledge of PTs was found to be adequate regarding the central nervous system and electrolyte disorders while average regarding toxicology, immunization, and endocrine system. Results suggested that residents (mean score: 21.42 ± 5.06) were significantly ($p=0.0165$) more knowledgeable than interns (mean score: 19.96 ± 5.08). Among respondents, 17.6% of interns and 13.4% of residents had poor performance while 45.9% of interns and 53.7% of residents had adequate performance.

Conclusions: The current study provides valuable information regarding the state of PTs' knowledge in medical emergencies among interns and residents, which can be used to improve undergraduate as well as postgraduate training.

Keywords: Emergency, Interns, Knowledge, Pharmacotherapeutics, Residents

INTRODUCTION

A medical emergency is an unpredictable injury or illness (psychological or physiological) seeking immediate medical care. This may cause loss of life or permanent health impairment in the patient. Also, the concept of

'golden hour' (i.e., the first few hours in medical or surgical) is of utmost importance to prevent considerable morbidity and mortality among patients. Emergency medical care concentrates on the provision of urgent medical interventions and helps in the prevention of death and disability. Globally, 28.3 million people died as a

result of emergency medical diseases (EMDs) in 2015, and EMDs were responsible for 50.7 % of deaths and 41.5 % of the total disease burden.¹ South-East Asia has the second highest burden of emergency conditions, accounting for 90% of deaths and 84% of disability-adjusted life years (DALYs).² As the world's second-most populous country, India has considerable increase in urbanization and EMDs instances during the last two decades.³ High-quality emergency care has the potential to prevent a substantial number of death and disability.² Unfortunately, there is an enormous rise in preventable deaths in India due to inadequate emergency care.³ Furthermore, non-communicable diseases (NCDs) have been the cause of most emergencies in recent years.⁴ Patients now have higher expectations regarding the quality of emergency medical care provided in their healthcare systems by medical professionals.⁵ Knowledge of Pharmacotherapeutics (PTs) is the backbone of emergency care. Thus, medical professionals must have detailed knowledge about PTs for the management of emergencies so they can provide timely, effective, proper, and compassionate care.⁶ But many medical professionals often face challenges in selecting, initiating, and individualizing appropriate drug therapy for patients in the emergency room.⁷ As medical interns and residents are future medical professionals and as first-line responders, they may confront any type of emergency. So, they should be skilled enough to handle emergencies. Guidelines regarding PTs used to treat emergency medical conditions are updated in a timely manner, therefore interns and residents must keep themselves updated. Therefore, this study was designed to assess the knowledge of PTs and also to identify the lacunae in handling various medical emergencies among medical interns and residents.

METHODS

A cross-sectional, observational, questionnaire-based study was carried out among the intern and resident doctors between December 2020 to February 2021 at Sheth L. G. Municipal General Hospital, Ahmedabad, Gujarat. A self-structured questionnaire containing 30 questions, assessing the knowledge of drugs utilized in various medical emergency conditions was prepared and circulated among the interns and residents in the form of a Google form. The questions were discussed and reviewed by the senior faculty members of the department of pharmacology. The questionnaire was pre-assessed and validated by faculty members from clinical departments. The necessary changes have been made to the questionnaire as per the suggestions given by the faculty members.^{8,9} Harrison's Principles of Internal Medicine, 20th edition, and Goodman and Gilman's The Pharmacological Basis of Therapeutics, 13th edition were used as references.^{8,9} All the questions were close-ended and the participants had to select one answer from four multiple options given for each question. Apart from questions addressing the different PTs, a few questions regarding how participants themselves evaluated their

knowledge in managing common medical emergencies and how their knowledge can be improved were also asked. Participants were instructed to mark the most appropriate option. A credit score of "1" was given for each correct response. A total of thirty minutes was allotted to answer the questionnaire. Grading of knowledge was also done as "poor" ($\leq 50\%$), "average" ($>50-70\%$), and "adequate" ($>70\%-100\%$). The confidentiality of the participants was well maintained, and data was collected anonymously. The study was conducted after getting the approval of the institutional review board (IRB). Prior consent was taken from the participants. Data collected over the stipulated time was entered into Microsoft Excel 2019 and Student's Unpaired t-test was used to analyse the data using Statistical package for social sciences (SPSS) version 20.0.

RESULTS

A total of 282 candidates responded, with 148 (52.5%) interns and 134 (47.5%) residents. Among the residents, 32 (23.9%) were in the first year, 40 (29.8%) in the second year, and 62 (46.3%) in the third year. Among the participants, there were 149 males (52.8%) and 133 females (47.2%) (Table 1).

Table 1: Demographic details (n=282).

Variable	N (%)	
Designation	Interns	148 (52.5)
	1st-year residents	32
	2nd-year residents	40
	3rd-year residents	62
	Total residents	134 (47.5)
Gender	Male	149 (52.8)
	Female	133 (47.2)

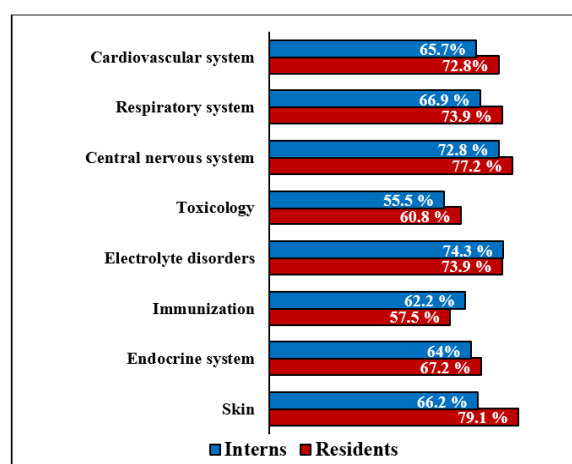


Figure 1: Knowledge of PTs for medical emergencies of various systems among interns and residents.

Among CVS emergencies participants had adequate knowledge of PTs for hypovolemic shock, PEA, cardiac

arrest, PSVT, and CPR ratio as depicted in (Table 2). While they had poor knowledge of PTs for anaphylactic shock. Knowledge of PTs for acute LVF was poor among interns and average among residents. Moreover, regarding the knowledge of PTs in hypertensive emergencies, interns had average while residents had adequate knowledge. Among RS emergencies, participants had adequate knowledge of PTs for status asthmaticus. While they had average knowledge of PTs for high altitude-related pulmonary oedema. Among CNS

emergencies, participants had adequate knowledge of PTs regarding status epilepticus and seizures in eclampsia. Whereas, they had average knowledge of PTs for elevated intracranial pressure. Regarding knowledge of the Glasgow coma scale and PTs for febrile seizures, interns had average while residents had adequate knowledge. Regarding knowledge of PTs for seizures during pregnancy, interns had adequate while residents had average knowledge (Table 2).

Table 2: Knowledge of PTs among interns and residents regarding emergencies involving the cardiovascular system, respiratory system, and central nervous system.

System	Medical emergency	Correct drug/dose	Correct response	
			Intern %	Resident %
CVS	Anaphylactic shock	Inj. adrenaline 1:1000, IM 0.5 ml	32.4	44.8
	Hypovolemic shock	0.9% NaCl or lactated ringer solution IV	85.1	85.8
	The ratio between chest compression and breaths for CPR*	30 compressions: 2 breaths	77	86.6
	Pulseless electrical activity (PEA)	Inj. adrenaline 1 mg and repeat after every 3-5 min IV	81.1	71
	Hypertensive emergency	Inj. sodium nitroprusside or Inj. glyceryl trinitrate or Inj. Labetalol IV	54	76.1
	First-line agent in cardiac arrest	Inj. adrenaline 1mg IV/IO repeated every 3-5 min	85.1	86.7
	Acute LVF (Left Ventricular Failure) without hypotension	Inj. furosemide IV	33.8	55.2
	Paroxysmal Supraventricular Tachycardia (PSVT)	Inj. adenosine IV	77	76.1
RS	High altitude-related pulmonary oedema	Rapid decent, nifedipine, and oxygen support	56.8	61.2
	Status asthmaticus	Inhale oxygen 4 l/min, inhale salbutamol, IV or oral corticosteroids	77	86.6
CNS	Status epilepticus	Inj. phenytoin or sodium valproate or lorazepam given IV	86.5	94
	Glasgow coma scale score in a comatose patient	Score: 3-8	67.6	80.6
	Elevated intracranial pressure	IV mannitol 0.75- 1.5 mg/kg	52	61.2
	Seizures in eclampsia	IV Mgso4	87.1	82.1
	Febrile seizures	Inj. lorazepam/ diazepam IV or per rectal diazepam	67.6	85.8
	Seizures during pregnancy	Levetiracetam or lamotrigine	75.7	59.7

Among toxicological emergencies, participants' knowledge of PTs was adequate for morphine poisoning and average for methanol poisoning. Regarding the knowledge of PTs for OP poisoning and snakebite, interns had poor while residents had average knowledge. Regarding electrolyte disorders, participants' knowledge of PTs was adequate for malignant hyperthermia and major burns while average for severe hyperkalaemia. Regarding PTs of severe tetany, interns had adequate while residents had average knowledge. Among emergencies involving immunization, participants' knowledge of PTs was average for tetanus. Regarding

PTs for dog bite, interns had average while residents had poor knowledge. Among endocrine emergencies, participants' knowledge of PTs was adequate for severe hypoglycaemia. Whereas participants had average knowledge of PTs for DKA and thyrotoxic crisis. Regarding the knowledge of PTs for pemphigus, interns had average while residents had adequate knowledge (Table 3). Participants' knowledge of PTs regarding CNS and electrolyte disorders was adequate. While participants had average knowledge of PTs in toxicology, immunization, and endocrine systems. Figure 1 depicts, that participants' knowledge of PTs regarding CNS and

electrolyte disorders was adequate. While participants had average knowledge of PTs in toxicology, immunization, and endocrine systems. Regarding knowledge of PTs among CVS, RS, and skin, interns had average while residents had adequate knowledge (Figure

1). The difference in mean scores regarding the knowledge of PTs for CVS, CNS, RS, and skin was found to be statistically significant as depicted in (Table 4). This clearly shows residents were significantly well-versed in the knowledge of PTs in these systems.

Table 3: Knowledge of PTs among interns and residents regarding emergencies involving toxicology, electrolyte disorders, immunization, endocrine system, and skin.

System	Medical emergency	Correct drug/dose	Correct response	
			Intern %	Resident %
Toxicology	Organophosphorus (OP) poisoning	Inj. atropine - 0.05 mg/kg IV, & Inj. pralidoxime 25-50 mg/kg IV	37.1	50.7
	Snakebite by a venomous snake	IV Anti-Snake Venom (ASV), Don't apply a tourniquet to block the blood supply, stop oral intake	43.2	58.2
	Severe methanol poisoning	Inj. fomepizole 15mg/kg IV, Inj. Folinic acid 1mg/kg 4-6 hourly, Inj. thiamine 100 mg 6 hourly, Inj. sodium bicarbonate	56.8	59.7
	Morphine poisoning	Inj. naloxone IV	85.1	74.6
Electrolyte disorders	Malignant hyperthermia (MH)	Inj. dantrolene sodium IV	74.3	74.6
	Major burns	Inhale oxygen, IV access, Crystalloid at 2-4ml/kg % of BSA* burnt, over 24 hours.	85.1	86.7
	Severe hyperkalaemia	IV 10% calcium gluconate	62.2	68.7
	Severe tetany	IV calcium gluconate	75.7	65.7
Immunization	Dog bite in non-immunized person	Human rabies immunoglobulin 20 IU/Kg, five injections of Essen regimen 1ml IM on days 0, 3, 7, 14, and 28 on the deltoid	63.5	47.8
	Tetanus	Inj. metronidazole 500 mg 8 hourly, Inj. human Tetanus Immunoglobulin (TIG) 3000-5000 units, Inj. Diazepam IV	60.8	67.2
Endocrine	Severe hypoglycaemia	Inj. glucagon 1 mg IM	75.8	80.6
	Diabetic ketoacidosis (DKA)	1L of normal saline rapidly, Inj. Insulin 5-10 Units/hr IV, KCL Inj. Sodium bicarbonate	58.1	67.2
	Thyrotoxic crisis	Tab. carbimazole/ methimazole/ propylthiouracil, Tab. propranolol, Lugol's iodine	58.1	53.8
Skin	Pemphigus	Prednisolone, azathioprine, rituximab	66.2	79.1

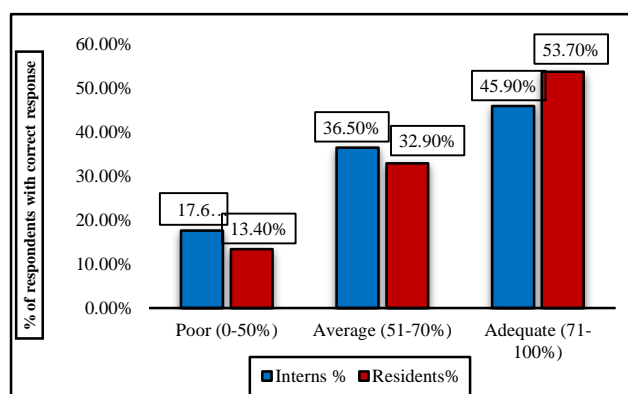


Figure 2: Performance assessment of interns and residents (n=282).

Whereas, the difference in scores of the interns and residents regarding the awareness of PTs for electrolyte disorders, immunization, endocrine disease, and toxicological emergencies was not found to be statistically significant. The overall mean score for interns and residents was (19.96±5.08) and (21.42±5.06), respectively. The difference in score was found to be statistically significant with a p value of 0.0165 (Table 4).

Figure 2 depicts the overall performance of interns and residents regarding knowledge of PTs for various medical emergencies. Out of all the responders, 17.6% of interns and 13.4% of residents had poor (≤50%), 36.5% of interns and 32.9% of residents had average (51-70%), 45.9% of interns and 53.7% of residents had adequate (71-100%) performance (Figure 2). Among all

emergencies, participants had the least knowledge of PTs for anaphylactic shock. Whereas, interns had the highest knowledge of PTs for seizures in eclampsia. While residents had the highest knowledge of PTs for major burns and cardiac arrest. Regarding the year of residency, third year residents had more adequate knowledge of PTs compared to first- and second-year residents.

Total 36.5% of interns found toxicological emergencies while 35.1% of residents found endocrine emergencies as the most challenging. Whereas, 39.2% of interns and 51.5% of residents found electrolyte emergencies as the least challenging. A higher proportion (81.8%, 71.6%) of interns and residents felt that there is a need for modification of the curriculum (Table 5).

Table 4: Comparison of mean scores of interns and residents in the knowledge of PTs for various emergencies.

Emergency	Interns (Mean±SD score)	Residents (Mean±SD score)	P value
Cardiovascular system	5.25±1.46	5.84±1.66	0.0017
Central nervous system	4.36±1.51	4.77±1.24	0.0139
Respiratory system	1.34±0.68	1.53±0.63	0.0159
Toxicology	2.21±1.03	2.43±1.13	0.0883
Electrolyte disorders	2.97±1.06	2.95±1.01	0.8558
Endocrine	1.93±0.95	2.01±0.89	0.4674
Skin	0.66±0.47	0.79±0.41	0.0144
Immunization	1.24 ±0.69	1.1±0.69	0.2750
Overall	19.96 ±5.08	21.42 ±5.06	0.0165

*p value<0.05: statistically significant.

Table 5: The feedback of the participants about the study and the questionnaire.

Question	Interns' response, N (%)	Residents' response, N (%)
How would you rate yourself regarding the knowledge of PTs?	Adequate: 79 (53.4) Average: 58 (39.2) Poor: 11 (7.4)	Adequate: 91 (67.9) Average: 34 (25.4) Poor: 9 (6.7)
About PTs, which system and individual emergency stood out as the most challenging for you?	Toxicology: 54 (36.5) Acute LVF without hypotension: 41 (27.7)	Endocrine: 47 (35.1) OP poisoning: 35 (26.1)
About PTs, which system and individual emergency stood out as the least challenging for you?	Electrolyte disorders: 58 (39.2) Hypovolaemic shock: 48 (32.4)	Electrolyte disorders: 69 (51.5) Status epilepticus: 45 (33.6)
Do you think training/ workshops can be helpful in handling various emergencies?	Yes:133 (89.9)	Yes: 112 (83.6)
Is there a need to modify the curriculum to improve prescribing skills and handle common emergencies?	Yes: 121 (81.8)	Yes: 96 (71.6)

DISCUSSION

Management of medical emergencies at a tertiary care teaching hospital is the prime responsibility of interns and residents. They should be knowledgeable, skilled, and able to organize their practices to provide prompt and efficient management for any medical emergency. Thus, the study aimed at assessing knowledge of drugs used in medical emergencies and looking for lacunas among medical interns and residents. According to the American heart association (AHA) guidelines, high-quality CPR is considered as the first line of treatment in cardiac arrest in an adult.¹⁰ In our study, a majority (77%, 86.6%) of interns and residents were found to be well aware of the CPR ratio. Similarly, a study done in India by Chandran et al portrays that 78% of young doctors were aware of the CPR ratio.¹¹ According to the AHA guidelines,

administration of adrenaline improves the survival of an adult patient suffering from cardiac arrest.¹⁰ A majority (85.1%, 86.7%) of interns and residents were found to be knowledgeable regarding adrenaline administration in cardiac arrest. In PTs regarding anaphylactic shock, only 32.4% of interns and 44.8% of residents were found to be knowledgeable. According to Jose et al junior doctors were found to be lacking in knowledge (16.8%) of the

correct dose and route of adrenaline administration in anaphylaxis.¹² As per recommendations of the AHA guidelines, diuretics should be administered immediately after acute heart failure for better outcomes.¹³ It was known to only 33.8% of interns and 55.2% of residents. Iv labetalol or Iv sodium nitroprusside is considered a life-saving drug for hypertensive emergencies.⁹ Only

54% of interns could correctly answer this in our study. Approximately 5-20% of asthmatic patients have severe asthma.¹⁴ In our study, both interns and residents were well-versed (77%, 86.6%) regarding PTs for status asthmatics. Similarly, in a study conducted by Bontsevich et al around 75.9% of medical students and 91.2% of doctors selected the correct basic asthma therapy depending on the severity.¹⁴ A similar study was conducted by Palacherla et al 79% of the medical students were known to the first-line management of status asthmatics.¹⁵ Febrile convulsion is the most common type of neurological disorder in the paediatric age group, IV lorazepam or diazepam is very efficient in terminating the seizures.¹⁶ This was known to 67.6% of interns and 85.8% of residents. Status epilepticus (SE) is one of the commonest neurological emergencies, with a fatality rate of 20%.¹⁷ In a study conducted by Khan et al only 66% of medical students were found to be aware of the first-line drug in SE.¹⁸ In our study, A higher percentage (86.5%, 94%) of interns and residents were found to be knowledgeable about PTs for SE. Only 59.7% of residents were knowing that levetiracetam or lamotrigine are safer drugs for seizures during pregnancy. The majority (87.1%, 82.1%) of interns and residents were well versed in treating seizures during eclampsia with IV MgSO₄. Over the past five decades, most pesticide suicides around the world have been caused by organophosphorus insecticides.¹⁹ In our study, 37.1% of interns and 50.7% of residents were aware of PTs for OP poisoning. A study conducted by Khan et al shows that 49.1% of medical undergraduates were aware of the dose of atropine to reverse muscarinic effects in OP poisoning.¹⁸ According to the study done by Palacherla et al 52.6% of medical undergraduates were aware of PTs for OP poisoning.¹⁵ The definitive treatment for the bite by a venomous snake is antivenom therapy.²⁰ ASV should not be given subcutaneously at the local site of injury, it was known to only 43.2% of interns and 58.2% of residents. Methanol poisoning is a medical emergency; and sometimes affects the mass population. If not treated timely, it can lead to a high magnitude of morbidity as well as mortality. In our study, 56.8% of interns and 59.7% of residents were found to be aware of PTs for methanol poisoning. Untreated malignant hyperthermia can progress to a life-threatening condition with a mortality rate of 80% yet it can be decreased to 5% with prompt recognition and appropriate treatment.²¹ Administration of dantrolene sodium is the preferred treatment for MH.²² In our study, interns and residents were found to be equally (74.3%, 74.6%) knowledgeable about PTs for malignant hyperthermia. In the management of severe burns, IV fluid should be replaced using parkland's formula.⁸ A study held by Lam et al shows that only 33.8% of healthcare professionals were aware of fluid resuscitation in burns using the Parkland formula.²³ A higher percentage (85.1%, 86.7%) of interns and residents in our study were knowledgeable about this. In PTs for DKA, 58.1% of interns and 67.2% of residents were found to be knowledgeable in our study. A study carried out by Madkhly et al shows lacunae in knowledge

among final-year medical students regarding fluid replacement in DKA patients.²⁴ Similarly, a study conducted by Singh et al at Southern Indian University, shows medical students had inadequate knowledge about DKA and its management.²⁵ Currently, the administration of antithyroid drugs, including methimazole and propylthiouracil, is considered a standard approach for the treatment of thyroid storm induced by severe thyrotoxicosis.²⁶ This was known to only 58.1% of interns and 53.8% of residents. After an animal bite, the only way to prevent rabies is by giving post-exposure rabies prophylaxis.²⁷ A study carried out by Singh et al shows that only 39% of the doctors knew about the correct post-exposure prophylaxis schedule.²⁸ only 47.8% of residents in our study were aware of this. Endocrinal emergencies are life-threatening as well as uncommon and managing the patient aggressively is equally important, because complications can prove fatal.²⁹ In our study, 35.1% of residents felt managing them was the most challenging. Electrolyte imbalance is one of the most common clinical complications observed in intensive care.³⁰ Possibly because interns and residents have more exposure to electrolyte disorders, emergencies related to electrolyte disorders were found to be the least challenging to them. Results suggested that residents (mean score: 21.42±5.06) were significantly (p value 0.0165) more knowledgeable than interns (mean score: 19.96±5.08). This clearly shows that knowledge of PTs is influenced by the additional clinical exposure as a resident. As interns are the first-line caregiver in emergencies at a tertiary care hospital, they are also expected to be well-versed with the knowledge. Thus, interns should be provided with specific training before being posted into emergency care. Even though PTs are taught as part of the curriculum, just 45.9 % of interns and 53.7% of residents have adequate knowledge (>71-100%). Moreover, lacunae in the knowledge of PTs among medical students is a global problem that requires serious attention.¹⁸ This makes it clear that there is a dire need to concentrate on the training of interns and residents for knowledge of PTs related to major and frequent emergencies. The majority (89.9%, 83.6%) of interns and residents believe that workshops and additional training can be helpful for the betterment of their knowledge of PTs in handling emergencies. A study held by Afzalimoghaddam et al conclude that additional training would improve medical interns' skills in emergency management.³¹ The results also reveal that a higher proportion of interns (81.8%) believe that there is a need for modification of the curriculum. In the present study, 53.4% of interns and 67.9% of residents self-rated their knowledge of PTs as adequate (71-100%). While only 7.4% of interns and 6.7% of residents self-rated their knowledge of PTs as poor (0-50%). However, this is in contrast to the objective findings in which only 45.9% of interns and 53.7% of residents had adequate knowledge whereas 17.57% of interns and 13.43% of residents had poor knowledge. This demonstrates that objective evaluation provides a more accurate picture of participants' knowledge levels than subjective ratings.

Limitations

Since this is a single centre study with a limited number of participants, the results can't be extrapolated to other institutions. The degree of PTs knowledge attained by medical interns and residents in India may be better understood by a large multicentric study. The questionnaire involves limited medical emergencies and drugs; however, it gives an idea about the status of knowledge of PTs among intern and resident doctors.

CONCLUSION

The current study provides valuable information about the state of knowledge regarding PTs for medical emergencies among interns and residents in an Indian tertiary care teaching hospital, which can be used to improve undergraduate as well as postgraduate training. Results revealed that second and third year residents had adequate while interns and 1st year residents had an average level of knowledge among PTs in most of medical emergencies. However, the knowledge they possess needs improvement.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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