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Original Article

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Evaluation of rotation experiences of emergency medicine specialist students

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ABSTRACT

Aims: This study aims to analyze emergency medicine residents' rotation experiences and training deficiencies, propose recommendations to improve these processes and contribute to future research in this field.

Methods: This cross-sectional study was conducted between September 1 and November 30, 2024. Data were collected via a digital survey and analyzed under three main categories: sociodemographic characteristics, rotation experiences, and training adequacy. Statistical analyses were performed using SPSS version 15, with a significance level set at $p<0.05$.

Results: The majority of participants (n=130) were between the ages of 30-35 (50%) and male (61.5%). Most had 2-4 years of residency experience, and a significant portion of participants worked in Training and Research Hospitals and City Hospitals (56.9%). It was noted that in-service training during rotations was not consistently provided, with only 24.6% of participants reporting that they received training in every rotation. Supervision of rotation programs was found to be more prevalent in Training and Research Hospitals. The anesthesia and reanimation, pediatrics, and cardiology departments were identified as the most contributory to training, while the radiology, obstetrics and gynecology departments were found to have limited contributions. Additionally, participants indicated that foreign rotations and departments such as thoracic surgery and plastic surgery should be added to the program. In contrast, departments like neurology and general surgery should be removed. Overall, it was concluded that rotations are more focused on filling service gaps rather than training, highlighting the need for improvements in duration, content, and supervision processes.

Conclusion: The extension of rotation durations, the structuring of in-service training, and the enhancement of supervision are recommended for emergency medicine residency training. While processes are evaluated positively in training and research hospitals, significant deficiencies in education and clinical infrastructure have been identified in medical faculties. Addressing these challenges and promoting inter-institutional collaboration is crucial for improving the efficiency of rotations.

Keywords: Emergency medicine, education, residency, rotation, supervision, training

INTRODUCTION

Emergency medicine residency training is a comprehensive educational process designed to develop clinical skills, behaviors, and attitudes through a curriculum based on fundamental principles aimed at enhancing the effectiveness and quality of healthcare services. This process not only focuses on acquiring the ability to intervene appropriately with patients; but also encompasses areas of personal development, such as knowledge transfer related to health, management, and research skills. These characteristics broaden the scope of emergency medicine education, while simultaneously necessitating a multifaceted curriculum to adapt to the ever-evolving dynamics of the healthcare sector.[1]

Emergency medicine is recognized as one of the essential specialties at the international level.[2] In Turkiye, the recognition of emergency medicine as an independent medical specialty occurred through a Cabinet decision on April 12, 1993, under the title "First and emergency aid." This decision was published in the Official Gazette on April 30, 1993, formalizing its status. With the inclusion of emergency medicine in the Regulation on Medical Specialization for

the first time and the establishment of the first Department of Emergency Medicine, this field gained recognition as an independent branch in the academic world.[3]

Currently, emergency medicine residency training in Turkey is conducted in universities and training research hospitals by national standards set by the Medical Specialization Board (MSB). The training period is four years, and it includes rotation programs that promote a multidisciplinary perspective and provide a broad knowledge base.[4] These rotations allow emergency medicine residents to develop their knowledge and skills in various specialties and contribute to their understanding of a multidisciplinary approach.[5]

The core curriculum of emergency medicine residency training is designed not only to enable students to acquire theoretical knowledge; but also to develop their practical skills through both in-clinic and out-of-clinic educational activities.[4] This structure ensures that residency students gain experience in various disciplines while fostering a multifaceted approach to disease and treatment processes.

However, there are some concerns regarding the efficiency of rotations and their contributions to education. While emergency medicine residents have the opportunity to observe the clinical practices of various specialties during rotations, feedback suggests that certain specialties, due to the intensity of their training processes, experience deficiencies. These feedbacks have sparked discussions about whether rotations meet students' educational expectations.[5] The inability of students to gain the expected experience in certain rotations or to acquire sufficient clinical practice indicates the necessity for more effectively structured educational content.[6]

This study aims to analyze the experiences and opinions of emergency medicine residency students regarding rotations, examining observed educational deficiencies and the underlying causes. Based on an analysis of the current literature, the study aims to provide recommendations for the improvement of the educational process. It is anticipated that the results of this study will guide and contribute to future research aimed at enhancing the efficiency of rotations and improving the quality of education in emergency medicine residency training.

METHODS

This study was conducted after obtaining approval from the Ethics Committee of Kahramanmaraş Sütçü İmam University, Faculty of Medicine (Date: 26.08.2024, Decision No: 03). Furthermore, by the Declaration of Helsinki, written informed consent was obtained from all participants involved in the study.

This cross-sectional study was conducted to analyze the rotation experiences and opinions of emergency medicine residents working in various university hospitals and training-research hospitals across Turkey. The study was conducted between September 1, 2024, and November 30, 2024. The study included emergency medicine residents who volunteered to participate and consented to the research. During the data collection process, the purpose and scope of the study were explained to the participants, and written informed consent was obtained.

Participants who were not emergency medicine residents or those who provided incomplete data were excluded from the study. Additionally, individuals who refused to participate in the study were also excluded from the study.

A questionnaire developed by the researchers, based on a literature review, was used to collect data. The questionnaire consisted of three main sections:

1. **Sociodemographic information:** This section included basic information such as gender, age, year of residency, and the institution where the participant was employed.
2. **Rotation experiences and opinions:** Questions regarding rotation durations, contents, availability, and adequacy of in-clinic training, the communication of rotation objectives, and the extent to which these objectives were achieved were included.
3. **Effectiveness and supervision of rotations:** This section assessed the adequacy of the education provided during rotations, supervision processes, and participants' recommendations regarding these processes.

The questionnaires were prepared electronically (via Google Forms) and distributed to participants via email and social media channels. Completing the questionnaire took approximately 10 minutes. Participants were allowed to complete the survey only once, and anonymity was ensured throughout the process.

Statistical Analysis

The collected data were analyzed using SPSS version 15 (Statistical Package for Social Sciences, SPSS Inc., Chicago, IL, USA). Descriptive statistics, including frequency and percentage distributions for categorical variables and mean±standard deviation (SD) or median (IQR: interquartile range) for continuous variables, were presented.

Differences between groups were analyzed using the Chi-square test or Fisher's exact test for categorical variables. A p-value of <0.05 was considered statistically significant.

This methodological approach was carefully designed to ensure that the study's findings were assessed in a reliable and valid manner.

RESULTS

Detailed analyses were conducted on the socio-demographic characteristics of the participants included in this study, their opinions regarding rotation programs, and the impact of these programs on residency training. The demographic characteristics of the participants, their rotation experiences, and their evaluations of these experiences are presented in detail below.

Sociodemographic Characteristics and Participant Profile

Among the 130 participants, 61.5% were male and 38.5% were female. The majority of participants (50.0%) were aged between 30–35 years, 39.2% were aged between 25–30 years, and 10.8% were over 35 years old. When considering the distribution based on years of residency, the largest groups were those with 2–3 years of experience (21.5%) and 3–4 years of experience (20.8%), followed by those with 1–2 years of experience, comprising 24.6%. Additionally, participants who have been working for more than 4 years or hold the title of emergency medicine specialist stand out, accounting for

23.1%. Based on the institutions where they work, 56.9% of the participants are employed in training and research or city hospitals, while 43.1% work in medical faculties.

Detailed information regarding the socio-demographic characteristics and participant profile of emergency medicine residents is presented in Table 1.

Table 1. Sociodemographic characteristics and participant profile

		n	%
What is your gender?	Male	80	61.5%
	Female	50	38.5%
What is your age?	>35	14	10.8%
	25-30	51	39.2%
	30-35	65	50.0%
What year of residency are you in?	Less than 1 year	13	10.0%
	1-2 years	32	24.6%
	2-3 years	28	21.5%
	3-4 years	27	20.8%
	More than 4 years or emergency medicine specialist	30	23.1%
Which of the following institutions do you work at?	Training and research hospital, city hospital	74	56.9%
	Faculty of medicine	56	43.1%

Evaluations of the Rotation Program

Participants were asked about the duration of their rotations and their opinions regarding its adequacy. Among them, 43.1% considered the rotation duration sufficient, 27.7% found it partially sufficient, and 18.5% deemed it insufficient. It was noted that in some cases, in-clinic training was beneficial; only 23.8% described this training as unhelpful.

Regarding the status of in-clinic training during rotations, 60.8% of participants reported receiving training in some rotations, 24.6% participated in training during every rotation, while 11.5% indicated that they did not receive any in-clinic education. In line with the recommended training year, 59.2% of participants started their rotations on time, 10.8% started earlier, 23.8% started later, and 6.2% were involved in the process due to compulsory inclusion.

Various parameters related to the rotation processes of emergency medicine residents-such as the status of in-clinic training, efforts to achieve rotation objectives, and evaluations of rotation duration-are presented in detail in Table 2.

Evaluation of Achievement of Rotation Objectives and Supervision Processes

The distribution of participants' success in achieving rotation objectives was evenly divided: 33.8% reported fully achieving their objectives, 33.1% partially achieving them, and 33.1% not achieving them at all. The proportion of participants who considered their efforts sufficient to meet these objectives was 47.7%, while 26.9% believed their efforts were insufficient (Table 3).

Variations were observed in the notification times for rotations: 42.3% were informed within one month, 23.8% within one year, 20% only a few days in advance, and 13.8% stated that they had not received any prior notification.

Table 2. Evaluations of the rotation program

		n	%
Do you think the duration of your rotation program is sufficient?	Yes	56	43.1%
	I have no idea	14	10.8%
	No	24	18.5%
	Partially	36	27.7%
What was expected of you during the rotations?	The training required for our specialty was focused on.	30	23.1%
	To fill the service gap, to address the shortage of residents and staff.	63	48.5%
	To complete our rotation period and return to our clinic.	36	27.7%
	Emergency on-calls continue during the rotation, and for the remaining days, rotations are carried out for up to 10 days.	1	0.8%
	I don't know	12	9.2%
Are there in-clinic training during the rotations you participate in?	Yes-some of them	79	60.8%
	Yes-all of them	24	18.5%
	No	15	11.5%
If you participated in in-clinic training during the rotations, did you find them useful?	Yes-some of them	70	53.8%
	Yes-all of them	29	22.3%
	No	31	23.8%
Did you participate in in-clinic training during the rotations?	Yes-some of them	61	46.9%
	Yes-all of them	32	24.6%
	No	37	28.5%
Did you complete the relevant rotation in the recommended training year?	Yes	77	59.2%
	No-earlier	14	10.8%
	No-later	31	23.8%
	No-I was required to complete it at the end of the training process.	8	6.2%

Table 3. Achievement of goals and effective supervision approaches in rotation processes

		n	%
Do you think you have put enough effort to achieve your rotation goal?	Yes	62	47.7%
	No	35	26.9%
	Partially	33	25.4%
Do you think you have achieved your rotation goals?	Yes	44	33.8%
	No	43	33.1%
	Partially	43	33.1%
Were your rotation goals communicated to you before starting the relevant rotation?	Yes-verbally	58	44.6%
	Yes-in written form	4	3.1%
	No	68	52.3%
Do you think the rotations should be better supervised?	Yes	61	46.9%
	I have no idea	24	18.5%
	No	45	34.6%
Is there a designated specialist or faculty member to supervise your rotation training in your clinic?	I don't know	43	33.1%
	Yes	54	41.5%
	No	33	25.4%

Approximately half of the participants (46.9%) expressed that rotations should be better supervised, indicating a perception of inadequacy in the current supervision mechanisms. On the other hand, 34.6% stated that no additional supervision was necessary, while 18.5% did not provide an opinion on the matter.

Responses regarding the assignment of authorized individuals for rotation supervision varied. While 41.5% of participants reported that such assignments were in place, 33.1% were unaware of any such arrangements, and 25.4% indicated that no such practice existed.

Table 3 provides a detailed analysis of emergency medicine residents' achievement of rotation objectives and their views on the supervision of rotations.

Table 4 shows the achievement of objectives and fulfillment of expectations for residents in different clinical rotations. Notably, high percentages of "No" responses were observed in the obstetrics and gynecology (39.2%), orthopedics and traumatology (32.3%), and pulmonology (32.3%) departments.

On the other hand, the cardiology department stood out with 35.4% of participants responding "Yes-partially," indicating that the majority reported partial success in meeting the rotation objectives. High rates of "I do not know the objectives" responses were reported in departments such as internal medicine, neurology, and radiology.

Analysis of Institutional Differences in Rotation Programs

Evaluations of the adequacy of rotation programs and participants' experiences revealed significant differences between institutions. Although there were no significant differences in rotation duration and contribution to education between training and research hospitals, city hospitals, and medical faculties ($p>0.05$), more positive results were obtained regarding the presence of in-clinic training in training and research hospitals ($p=0.010$).

The supervision of rotations also showed variability. In training and research hospitals (48.6%), supervision was performed at a higher rate than in medical faculties (42.9%), although this difference was not statistically significant ($p=0.339$).

Regarding the method of informing participants about rotation objectives, oral notification was common in both institutions (training and research hospitals: 43.2%; medical faculty: 46.4%), while the written notification was rare, and particularly absent in medical faculties.

Table 5 provides a more detailed assessment of the contribution of each institution to the rotation process and educational opportunities through comparisons between training and research hospitals, city hospitals, and medical faculties.

Rotations Contributing to Residency Training

Approximately 29.2% of participants regarded the anesthesia and reanimation department as the most beneficial rotation, followed by the pediatrics (20.8%) and cardiology (16.9%) departments (Table 6).

The rotations contributing the least were internal medicine, obstetrics and gynecology, with 16.9% of participants finding these rotations inadequate. Additionally, the radiology department was identified as another area with low contribution, with 13.8% of participants rating it as less impactful.

Table 6 summarizes the contribution levels of rotations in emergency medicine residency training, along with participants' opinions on rotations that should be added or removed from the program.

Rotations to be Added or Removed

Sixty percent of participants indicated a need for additional rotations. The most frequently suggested rotation specialties were international emergency clinics (24.6%), thoracic surgery (18.5%), and plastic reconstructive surgery (13.8%).

Regarding rotations that should be removed from the curriculum, 36.2% of participants recommended eliminating certain rotations. Neurology (18.5%), general surgery (10.0%), and radiology (9.2%) were among the most frequently suggested rotation specialties for removal.

DISCUSSION

Emergency medicine is a multidisciplinary field that was first introduced to Turkey in 1993 by emergency medicine specialist Dr. John Fowler. Specialization training in this discipline began in 1994, and it has since continued to expand its impact at an accelerating pace.[1,5] An emergency medicine specialist is responsible for managing emergency medical care, organizing research and educational activities,

Table 4. Interdepartmental rotations: evaluation of participants' achievement of rotation goals and the level of expectation fulfillment

	Yes-partially		Yes-completely		No		I don't know the goals	
	n	Row %	n	Row %	n	Row %	n	Row %
Anesthesiology and reanimation	42	32.3%	8	6.2%	45	34.6%	35	26.9%
General surgery	24	18.5%	10	7.7%	47	36.2%	49	37.7%
Internal medicine	28	21.5%	17	13.1%	44	33.8%	41	31.5%
Cardiology	46	35.4%	14	10.8%	31	23.8%	39	30.0%
Obstetrics and gynecology	21	16.2%	4	3.1%	51	39.2%	54	41.5%
Pediatrics	31	23.8%	10	7.7%	38	29.2%	51	39.2%
Neurology	25	19.2%	12	9.2%	36	27.7%	57	43.8%
Pneumology	28	21.5%	8	6.2%	42	32.3%	52	40.0%
Radiology	27	20.8%	12	9.2%	36	27.7%	55	42.3%
Orthopedics and traumatology	18	13.8%	8	6.2%	42	32.3%	62	47.7%

Table 5. Data on the analysis of questions by institutions

		TRH, City hospital	Faculty of medicine	p value
Do you think the duration of your rotation program is sufficient?	Yes	28 (37.8%)	28 (50.0%)	0.516
	I have no idea	8 (10.8%)	6 (10.7%)	
	No	16 (21.6%)	8 (14.3%)	
To what extent do you think the rotations contribute to your specialty training?	Partially	22 (29.7%)	14 (25.0%)	0.719
	Low	16 (21.6%)	13 (23.2%)	
	Unnecessary	6 (8.1%)	4 (7.1%)	
	Moderate	30 (40.5%)	27 (48.2%)	
	Adequate	22 (29.7%)	12 (21.4%)	
Are your rotations supervised?	I don't know	12 (16.2%)	15 (26.8%)	0.339
	Yes	36 (48.6%)	24 (42.9%)	
	No	26 (35.1%)	17 (30.4%)	
Did you participate in in-clinic training during your rotations?	Yes-some of them	34 (45.9%)	27 (48.2%)	0.235
	Yes-all of them	22 (29.7%)	10 (17.9%)	
	No	18 (24.3%)	19 (33.9%)	
Was there in-clinic training during the rotations you participated in?	I don't know	4 (5.4%)	8 (14.3%)	0.010
	Yes-some of them	44 (59.5%)	35 (62.5%)	
	Yes-all of them	20 (27.0%)	4 (7.1%)	
	No	6 (8.1%)	9 (16.1%)	
Were your rotation goals communicated to you before starting the relevant rotation?	Yes-verbally	32 (43.2%)	26 (46.4%)	0.209
	Yes-in written form	4 (5.4%)	0 (0.0%)	
	No	38 (51.4%)	30 (53.6%)	
Do you think you have achieved the goals of the rotation?	Yes	26 (35.1%)	18 (32.1%)	0.938
	No	24 (32.4%)	19 (33.9%)	
	Partially	24 (32.4%)	19 (33.9%)	
Do you think you have put enough effort into achieving your rotation goals?	Yes	40 (54.1%)	22 (39.3%)	0.241
	No	18 (24.3%)	17 (30.4%)	
	Partially	16 (21.6%)	17 (30.4%)	
When were you informed about the rotations you would be taking?	<1 month	36 (48.6%)	19 (33.9%)	0.321
	<1 year	14 (18.9%)	17 (30.4%)	
	A few days ago	14 (18.9%)	12 (21.4%)	
	I was not informed	10 (13.5%)	8 (14.3%)	
Did you take the relevant rotation in the recommended year of your training?	Yes	46 (62.2%)	31 (55.4%)	0.116
	No-earlier	4 (5.4%)	10 (17.9%)	
	No-later	18 (24.3%)	13 (23.2%)	
	No-i was required to complete it at the end of the training process.	6 (8.1%)	2 (3.6%)	

The Chi-square test was used. It is expressed as column percentages. TRH: Training and research hospital

providing health information to the community when necessary, and ensuring the effective assessment of patients presenting with acute illness or injury in critical situations, with the necessary equipment and authority.[1] Additionally, considering that each hospital's emergency department serves an average of 1.000 patients daily, emergency medicine undoubtedly plays a significant role in the healthcare system of the country.[7,8] In fact, according to data from 2021, nearly half (48.6%) of the 1.61 hospital visits per capita were made directly through emergency services.[8,9] Considering the patient load in emergency departments, the intensive practical requirements encountered during residency training, and the increasing role of emergency medicine specialists, it is concluded that the quality of emergency medicine education must be enhanced.

For almost 30 years, emergency medicine specialty training in Turkey has not only ensured that patients are treated in the best possible way with a modern approach; but has also encouraged the advancement of high standards in emergency care.[1] Associations representing the field of emergency medicine in Turkiye, along with related studies, report that emergency medical services in recent years have approached the standards observed in developed countries.[10] Considering the continuously evolving practices and innovations in emergency medicine, it becomes evident that a standardized training program must be implemented for residents during the specialization process. In this context, the "Emergency Medicine Proficiency Board" has been established in Turkey, and specific standards for specialization in emergency medicine have been developed.[11] However, despite these advancements, there is a lack of objective data regarding the

Tablo 6. Contribution levels of rotations to specialist training and participants' perspectives on rotations to be added or removed

		n	Row %
Which rotation has contributed the most to your specialty training?	Anesthesiology and reanimation	38	29.2%
	Pediatrics	27	20.8%
	Cardiology	22	16.9%
Which rotation has contributed the least to your specialty training?	Internal medicine	22	16.9%
	Obstetrics and gynecology	22	16.9%
	Radiology	18	13.8%
Do you think some rotations should be added?	Yes	78	60.0%
	I have no idea	14	10.8%
	No	38	29.2%
If so, what should be added? (Multiple answers were provided.)	Emergency departments abroad	32	24.6%
	Thoracic surgery	24	18.5%
	Plastic reconstructive and aesthetic surgery	18	13.8%
Do you think some rotations should be removed?	Yes	47	36.2%
	I have no idea	16	12.3%
	No	67	51.5%
If so, which ones should be removed? (Multiple answers were provided.)	Neurology	24	18.5%
	General surgery	13	10.0%
	Radiology	12	9.2%

implementation of emergency medicine residency training programs. In particular, several deficiencies exist concerning the duration, content, educational contributions of rotations, and their ability to meet trainees' expectations.[5]

In Turkiye, the first evaluation study of emergency medicine education was conducted by Aksay and colleagues[5] in 2006. This study revealed that emergency medicine residents did not find the rotations in their training programs to be efficient and emphasized the need for further research in this area. The number of studies in the literature examining the effectiveness and efficiency of rotations is limited, and no feedback mechanism supervises the educational process.[6] In this context, our study aims to determine the current opinions of residents about the content of the training program and to contribute to the improvement of the quality of emergency medicine education.

The total duration of emergency medicine specialty training in Turkiye is 4 years, with 9 months of this period spent in clinical rotations across relevant specialties. The current rotation program, approved by MSB with decision number 727 in 2016, specifies the duration of rotations and recommended specialty training years.[4] In the first year of specialty training, rotations in anesthesiology and reanimation, general surgery, internal medicine, and cardiology each last one month. In the second year, the rotations in pediatrics last two months, while obstetrics and gynecology, neurology or pulmonology, and orthopedics and traumatology or radiology each last one month.[4] This program aims to provide experience in basic specialties during the first two years of specialty training. However, a study by Sezik and colleagues[6] found that residents were sent to rotations later than planned, and these rotations were forced to be completed at the end of the training process. Similarly, in our study, 40.8% of participants reported that they could not attend rotations in the recommended training year. This recurring issue suggests that, despite the MSB decision, specialty training institutions are not sufficiently monitored, and if the decision is not implemented, no effective sanctions are applied.

In our study, 18.5% of participants indicated that the rotation program's duration was insufficient, leading to difficulties, while 33.1% stated that they could not achieve the rotation objectives. Similar results were found in previous studies. Aksay et al.[5] reported that 44.7% of students could not reach the objectives of the rotations, and Sezik and colleagues[6], in a study conducted five years later, identified challenges in achieving the same objectives. Our findings suggest that these issues persist today. These results indicate that the regulations in emergency medicine specialty training may have been insufficient and that the rotation programs should undergo a more comprehensive evaluation. We believe that MSB, along with emergency medicine associations and foundations, should take greater responsibility for making the rotation programs more functional by developing new proposals and implementing the necessary regulations. Additionally, to strengthen the multidisciplinary aspect of emergency medicine specialty training, rotations in certain clinical specialties should be extended and enriched in terms of content.

The responses to the questions regarding the presence of in-clinic training during rotations indicate that participants working in research and training hospitals have a higher rate of receiving training in each rotation, whereas this rate is significantly lower in medical faculties. Similarly, in a study by Sezik et al.,[6] it was reported that emergency medicine residents working in research and training hospitals performed specific interventional procedures at a higher rate. These findings suggest that residents in medical faculties do not have equal opportunities for quality training, clinical skill development, and practical experience compared to their counterparts in research and training hospitals. To address this inequality, it is emphasized that the educational programs in medical faculties should be improved, and more opportunities should be provided for developing clinical skills.

According to our research results, a large portion of participants (76.2%) found the in-clinic education during rotations to be beneficial. However, 60.8% of the participants stated that in-clinic education was only available in some rotations. This indicates that there are significant differences in the standards applied to educational processes across clinical departments. Consequently, it is once again emphasized that the educational content of rotation programs should be reviewed, gaps should be addressed, and educational processes in clinics should be regularly monitored. Such measures would increase the contribution of rotations to the overall quality of education and facilitate the achievement of training goals during the residency period.

In our study, the rotations that contributed most to the education of the residents were anesthesiology and reanimation (29.2%), pediatrics (20.8%), and cardiology (16.9%). Similarly, in the literature, the cardiology rotation has been reported as one of the clinical departments providing the greatest contribution to education.[5,6] This can be explained by the high number of patients in the

emergency department requiring electrocardiographic and echocardiographic evaluations, making the knowledge gained during the cardiology rotation critically important in daily clinical practice. The knowledge and skills gained in the management of cardiac emergencies are believed to enhance residents' professional competence.

Consistent with our findings, the anesthesiology and reanimation rotation is also reported as one of the most valuable rotations in terms of educational contribution.[5] In this rotation, emergency medicine residents gain experience in interventional procedures such as sedation and analgesia, peripheral nerve block, endotracheal intubation, tracheostomy, and central venous catheterization, which help reinforce these skills. These findings highlight the importance of clinical rotations, which are foundational to emergency medicine education, and underscore their role in enhancing residents' professional skills and knowledge.

The rotations most frequently requested for removal were neurology (18.5%), general surgery (10.0%), and radiology (9.2%). Similar to our findings, in Aksay et al.'s[5] study, the general surgery rotation was reported as one of the least contributing rotations to education. This may be related to the reduced preference for surgical specialties by physicians today, resulting in a higher workload and patient volume that limits the time allocated to educational processes. Removing the rotations that contribute the least to emergency medicine education from the current curriculum, making improvements to increase their efficiency, or offering them as elective rotations could be effective approaches to address these issues. Such measures would not only improve the effectiveness of the educational program but also offer a structure that better meets the educational needs of residents.

Our study findings reveal that rotation programs have deficiencies in terms of both duration and content, and significant issues exist in their implementation. While some rotations provide substantial educational benefits; others fall short in this regard. Research and training hospitals offer better clinical experience opportunities, while medical faculties experience educational inequality. This situation suggests that there is a need for a re-evaluation of the rotation programs, enrichment of their content, and the establishment of more equitable educational processes.

Limitations

Our study has the general limitations associated with survey-based research. Since our data reflect the personal opinions of both emergency medicine residents and emergency medicine specialists, which are subjective in nature, this should be considered when interpreting the results. Additionally, the exclusion of opinions from the education coordinators in the rotation clinics limits the scope of our findings to some extent.

In the future, studies evaluating the effectiveness of rotations through more comprehensive methods and including different stakeholder groups (such as education coordinators in rotation clinics) could contribute more to the literature and provide a stronger foundation for making changes in clinical practices.

CONCLUSION

This study provides significant insights into the rotation experiences of emergency medicine residents. While rotations are primarily expected to be education-focused, the majority of participants reported being required to adopt an approach centered on fulfilling service needs and returning to their clinical departments. The findings highlight the need for increased supervision of clinical training and rotation processes. Additionally, extending rotation durations and making training content more comprehensive are among the key suggestions put forward by the participants.

Participants working in training and research hospitals are more engaged in clinical training and tend to evaluate these processes more positively. This suggests that the educational infrastructure and supervision mechanisms in these hospitals are more effective compared to those in medical faculties. The findings emphasize the importance of standardizing educational content and sharing best practices to enhance rotation effectiveness. In this context, developing new approaches for improving the current system and implementing these approaches plays a crucial role in increasing the overall quality of rotation programs.

The primary reasons for not achieving rotation goals include deficiencies in clinical infrastructure, insufficient educational opportunities, and limited chances for hands-on procedures. To address these issues, strengthening inter-clinic collaboration and planning the educational process by the needs are essential. Improving clinical infrastructure, providing various educational materials, and creating environments that allow for hands-on practice in procedures are of critical importance. Furthermore, establishing regular feedback mechanisms and developing solution-oriented approaches will enhance the effectiveness of rotation programs.

ETHICAL DECLARATIONS

Ethics Committee Approval

This study was conducted after obtaining approval from the Ethics Committee of Kahramanmaraş Sütçü İmam University, Faculty of Medicine (Date: 26.08.2024, Decision No: 03).

Informed Consent

All patients signed and free and informed consent form.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

The authors declared that this study has received no financial support.

Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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Original Article

Retrospective analysis of 1-month and 1-year mortality due to bleeding in patients using warfarin

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ABSTRACT

Aims: Warfarin is approved for the prevention and/or treatment of venous thrombosis, pulmonary embolism, and thromboembolic complications associated with atrial fibrillation and/or cardiac valve replacement. International normalized ratio (INR) above the therapeutic range increases the risk of bleeding, its level below the therapeutic range increases the risk of thromboembolic complications. We aimed to evaluate the effect of patients' INR levels on one-month and one-year mortality.

Methods: The hospital's electronic information management system retrospectively screened between 01.01.2015, and 31.12.2016. Patients who applied to the emergency department (ED) with a history of warfarin use, were included in the study. The receiver operating characteristics (ROC) analysis and the area under the curve (AUC) for the mortality estimation calculations were used for statistical analysis.

Results: Total of 1299 patients with elevated INR due to warfarin use were included in the study. The major ED admission causes were bleeding (n=338, 26.02%) and INR control with no other complaint (n=56, 4.31%). Mortality was observed within one month in 118 (9.1%) patients and within one year in 292 (22.5%) patients. The ROC analysis for 1-month and 1-year mortality estimation, AUC values for age, INR, urea, and creatinine were 0.640, 0.549, 0.702, 0.629 and 0.629, 0.532, 0.671, 0.608, respectively.

Conclusion: The patients admitted to ED due to high INR values are usually corrected their INR values and then discharged. These patients' one-year mortality is high so to identify and eliminate the underlying cause of the INR elevation is important.

Keywords: Warfarin, emergency department, mortality, international normalized ratio

INTRODUCTION

Warfarin is approved for the prevention and/or treatment of venous thrombosis, pulmonary embolism, and thromboembolic complications associated with atrial fibrillation and/or cardiac valve replacement and to reduce the risk of death, recurrent myocardial infarction, and thromboembolic events after myocardial infarction.[1]

Warfarin and other vitamin K antagonists (VKA) (acenocoumarol, phenprocoumon, fluindione) are used in various clinical settings. Warfarin is still widely used, despite increasing interest and investigations focused on the effectiveness of direct oral anticoagulants (DOACs).[2] Their use is challenging because their therapeutic range is narrow, and dosing is affected by many factors, including genetic variation, drug interactions, and diet.[3] On the other hand, while international normalized ratio (INR) above the therapeutic range increases the risk of bleeding, its level below the therapeutic range increases the risk of thromboembolic complications.[4] So, there is a need for frequent monitoring and the associated risk of bleeding and other side effects.[5]

This study is aimed to evaluate the effect of patients' INR levels on one-month and one-year mortality.

METHODS

This retrospective observational study was conducted in a tertiary education and research hospital with 450.000 patient admissions annually. This study was conducted in accordance with the 1989 Declaration of Helsinki and was approved by the local ethics committee. This study was approved by the Clinical Researches Ethics Committee of University of Health Sciences Şişli Hamidiye Etfal Training and Research Hospital (Date: 17.10.2017, Decision No: 870). Patients who applied to the emergency department (ED) between January

1, 2015, and December 31, 2016, with a history of warfarin use, were included in the study. We retrospectively screened the hospital's electronic information management system and patient charts. Gastrointestinal bleeding, hematuria, mucosal bleeding, abdominal pain, and ecchymosis were considered side effects. Exclusion criteria were missing data and younger than 18 years of age.

We recorded demographic data, warfarin indications, primary complaints at ED admission, Complete blood count (CBC), INR, prothrombin time (PT), activated partial thromboplastin time (aPTT), urea, creatinine, AST, ALT results, and treatments given in the ED. One-month and one-year mortality were retained from the nationwide demographics system. The primary outcome was the length of stay time (LOS). Secondary outcomes were one-month and one-year mortality rates.

Statistical Analysis

We used the Kolmogorov-Smirnov test for the normal distribution of data. Results were reported as mean±standard deviation (SD) for continuous variables with normal distribution; median and interquartile range (IQR) for non-normally distributed variables; and frequency and percentage for categorical variables. The contribution of the variables to mortality prediction was evaluated with multivariate regression analysis, and the odd's ratio was calculated. We performed a Kaplan-Meier analysis for the mortality rate analysis. A p-value of <0.05 was considered statistically significant. We used SPSS 20.0 statistical package for the analyses.

RESULTS

We included a total of 1299 patients with elevated INR due to warfarin use in the study. 45.1% (n=586) of the patients were male, the mean age was 68.4±14.9 (min-max: 18-104) years, and the mean INR value was 4.2±2.1 (min-max: 2.5-14.2).

Indications for warfarin were atrial fibrillation (AF) 39.2% (n=509), deep vein thrombosis (DVT) 1.8% (n=23), cardiac valve replacement 35.4% (n=460), stroke 22.2% (n=288), and others % 1.5 (n=19).

The major ED admission causes were bleeding (n=338, 26.02%) and INR control with no other complaint (n=56, 4.31%). The distribution of bleeding symptoms by systems is given in Table 1. In the comparison of the patients presenting with bleeding symptoms and without bleeding symptoms, the INR values were 4.9±2.6 (2.5–14.2) and 3.9±1.8 (2.5–14.0), respectively, and there was a statistically significant difference between the groups (p<0.001).

Table 1. The distribution of bleeding symptoms by systems

	n	%
Cardiovascular	2	0.6
Thorax	7	2.1
Musculoskeletal	162	47.9
Gastrointestinal	68	20.1
Genitourinary	69	20.4
Ear nose throat	30	8.9
Total	338	100.0

The treatments given in the ED were erythrocyte suspension (n=110, 8.5%), fresh frozen plasma (n=183, 14.1%), and vitamin K (n=229, 17.6%). 986 (75.9%) patients were followed without treatment.

Mortality was observed within one month in 118 (9.1%) patients and within one year in 292 (22.5%) patients. Age, APTT, white blood cell (WBC), hemoglobin (HGB), platelet (PLT), urea, creatinine, AST, vitamin K treatment, and follow-up without treatment showed statistically significant differences between patients who died and survived within one month (p<0.05). Besides, compared to the one-year mortality, age, APTT, WBC, HGB, PLT, urea, creatinine, and AST values showed a statistically significant difference between mortality and non-mortality groups (p<0.05). INR value did not show a statistically significant difference between the groups for one-month and one-year mortality (Table 2).

In multivariate logistic regression analysis for 1-month mortality, age (p=0.000, odds ratio: 1.049), WBC (p=0.042, odds ratio: 1.028), urea (p=0.002, odds ratio: 1.007) and AST (p=0.016, odds ratio: 1.002) was identified as an independent risk factor. Besides, age (p=0.000, odds ratio: 1.030), aPTT (p=0.000, odds ratio: 1.013), WBC (p=0.046, odds ratio: 1.028), urea (p=0.000, odds ratio: 1.011) and creatinine (p=0.022, odds ratio: 0.807) were determined as independent risk factors in the multivariate logistic regression analysis for 1-year mortality.

Kaplan-Meier analysis showed a mortality rate of 9.1% for 1-month and 22.5% for 1-year and estimate survive time was 292 days at INR ≥3.5 group and 306 days at INR <3.5 group (Figure).

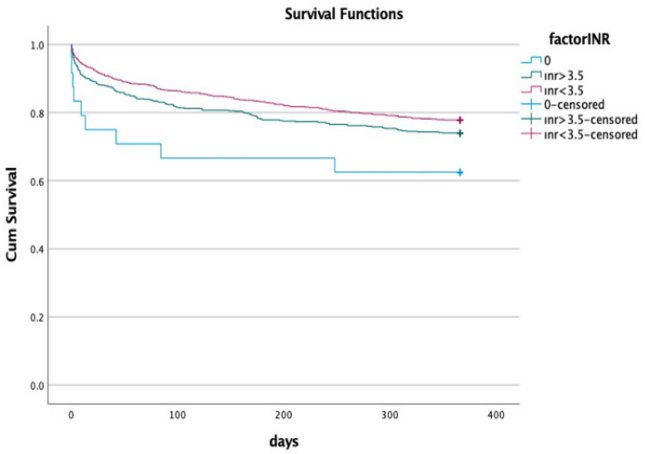

Figure. Mortality of the patients according to Kaplan–Meier analysis
INR: International normalized ratio

DISCUSSION

We primarily concluded that patients with high INR levels admitted to ED have high one-year mortality rates, and age, aPTT, WBC, HGB, PLT, urea, creatinine, and AST values are independent factors.

To the best of our knowledge, no study that includes all warfarin-related side effects has been reported in the current literature.[6] One-month and one-year mortality were studied only for bleeding due to warfarin-induced high INR in the

Table 2. Comparison of demographic data and laboratory results

		One month mortality						One year mortality					
		n	Mean	SD	Lower	Upper	p	n	Mean	SD	Lower	Upper	p
Age	Survive	1181	67.64	15.17	18	104	<0.001	1007	66.73	15.35	19	101	<0.001
	Mortal	118	75.81	10.40	39	94		292	74.07	12.00	18	104	
INR	Survive	1181	4.13	2.10	2.50	14.20	0.304	1007	4.14	2.12	2.50	14.2	0.688
	Mortal	118	4.34	2.08	2.50	12.50		292	4.19	1.99	2.50	14	
PT	Survive	1181	53.10	29.95	6.88	349	0.383	1007	53.18	30.71	6.88	346	0.744
	Mortal	118	55.61	28.07	11.7	159		292	53.83	26.40	11.70	159	
aPTT	Survive	1179	65.78	27.71	5.29	251.10	<0.001	1005	65.62	27.34	5.29	251.10	0.005
	Mortal	118	77.79	41.70	27	240		292	71.17	35.47	27	240	
WBC	Survive	1105	9.51	3.99	1.48	46.40	<0.001	937	9.35	3.73	1.48	46.40	<0.001
	Mortal	117	11.84	7.13	0.53	51.57		285	10.99	6.04	0.53	51.57	
HGB	Survive	1106	11.96	2.39	2.80	18.30	<0.001	937	12.01	2.35	2.80	18.30	<0.001
	Mortal	117	10.98	2.61	3	17.40		286	11.39	2.63	3	17.40	
PLT	Survive	1105	252.03	90.68	25	979	0.021	936	252.70	88.96	25	979	0.068
	Mortal	117	231.55	96	47	740		286	241.44	98.50	39	767	
Urea	Survive	1046	59.38	45.43	0.61	404.40	<0.001	882	55.92	41.94	0.61	404.40	<0.001
	Mortal	117	97.06	71.46	18.90	396		281	85.95	64.27	15	396	
CREA	Survive	1046	1.29	1.33	0.25	27.10	<0.001	882	1.27	1.37	0.25	27.10	<0.001
	Mortal	117	1.85	1.54	0.18	7.81		281	1.58	1.29	0.17	7.81	
ALT	Survive	1045	26.38	59.33	0	810.10	<0.001	882	25.52	58.59	0	810.10	0.005
	Mortal	117	59.23	217.47	1.80	2270.60		281	42.76	148.69	1.60	2270.60	
AST	Survive	1045	33.30	85.13	1.13	1622	<0.001	882	31.74	85.86	2.30	1622	0.001
	Mortal	117	111.54	488.50	4.30	5120.30		281	70.77	322.27	1.13	5120.30	

SD: Standard deviation, INR: International normalized ratio, PT: Prothrombin time, aPTT: Activated partial thromboplastin time, WBC: White blood cell, HGB: Hemoglobin, PLT: Platelet, CREA: Creatinine

ED. In our study, one-month and one-year mortality were relatively high. In high INR value patients, Conti et al.[6] also found similar mortality rates for 1-month and 1-year at 6% and 17%, respectively.

In various studies conducted in this area, the high-risk age has been reported as 65.14±14.8, 64.2±13.3, and 68.8 (29-85).[7-9] In our study, the mean age of the patients was 68.4±14.9 (18-104), which was considered compatible with the literature. Many studies have determined that the risk of high INR due to the use of warfarin increases in elderly patients. This may be due to inadequate drug compliance, increased risk of other drug interactions due to multiple drug use, and decreased warfarin clearance by age.[10,11]

In addition, in our study, in terms of 1-month and 1-year mortality, age, aPTT, WBC, HGB, PLT, urea, creatinine, and AST values were found to differ between mortality and non-mortality groups. The reasons for the difference in these parameters are considered as the low physiological reserve in advanced ages; aPTT, HGB, and PLT indicate the severity of blood loss due to coagulopathy and bleeding complications; WBC elevation secondary to early stressor response; co-morbidities and drug use triggering AST elevation; and warfarin is preferred over DOACs in patients with chronic renal failure. While vitamin K treatment made a difference between the mortality and non-mortality groups for 1-month mortality, that was not valid for 1-year mortality.

Since warfarin pharmacokinetics are complicated, its therapeutic index is narrow and affected by many factors. It has been reported that INR values of ≤2 increase the thromboembolism risk, and INR values of ≥5 increase the risk of significant bleeding.[12] Close monitoring is recommended to keep the INR level in the range of 2-3. In our study, in which we included patients who developed bleeding complications due to warfarin treatment, the INR values were 4.2±2.1 (2.5–14.2), in line with the literature. No significant correlation was reported between INR level and major bleeding.[13-15] In our study, the INR value was higher in patients with bleeding symptoms than in those who do not have a bleeding complication. In addition, we found that high INR did not affect one-month and one-year mortality rates. Still, bleeding complications were not divided into major and minor in our study.

Drug interactions or superimposed conditions (e.g., liver disease, malabsorption) that may interfere with warfarin ingestion, absorption, or metabolism are the most common causes of a supratherapeutic INR. In our study, the most common indication among the patients with a high INR was AF. Due to all these reasons, while warfarin is widely used, especially in patients with chronic kidney disease or heart valve replacement, DOACs are preferred anticoagulants.[3,5]

CONCLUSION

The patients admitted to ED due to high INR values are usually corrected their INR values and then discharged. Especially keeping in mind that their one-year mortality is high, we recommend to identify and eliminate the underlying cause of the INR elevation and to follow up with these patients more closely.

ETHICAL DECLARATIONS

Ethics Committee Approval

This study was approved by the Clinical Researches Ethics Committee of University of Health Sciences Şişli Hamidiye Etfal Training and Research Hospital (Date: 17.10.2017, Decision No: 870).

Informed Consent

Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

The authors declared that this study has received no financial support.

Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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Original Article

The comparison of ultrasound, chest X-ray, and chest CT in the diagnosis of pneumothorax in thoracic trauma patients

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ABSTRACT

Aims: Pneumothorax (PTX) is a critical condition frequently encountered in thoracic trauma that requires prompt diagnosis and management. This study aimed to compare the diagnostic accuracy of ultrasound (USG), chest X-ray (CXR), and thoracic computed tomography (CT) in detecting PTX in patients with thoracic trauma.

Methods: A prospective study was conducted on patients presenting to the emergency department with thoracic trauma. Each patient underwent an initial USG examination using the Extended focused assessment with sonography for trauma (E-FAST) protocol, followed by CXR and CT. The sensitivity, specificity, and diagnostic accuracy of USG and CXR were evaluated using CT as the reference standard.

Results: CT confirmed PTX in 15 cases (13%) among the studied patients. USG demonstrated a sensitivity of 73.3% and a specificity of 100%, while CXR showed a sensitivity of 0.0% and a specificity of 98.7%. The diagnostic accuracy of USG was significantly superior to that of CXR.

Conclusion: USG is a highly specific and efficient bedside tool for diagnosing PTX in thoracic trauma patients. Its implementation in emergency settings can facilitate early detection and management, particularly when CT is unavailable or delayed.

Keywords: Pneumothorax, ultrasound, chest X-ray, computed tomography, emergency department

INTRODUCTION

Traumas are a significant public health problem, especially affecting the young population. In Turkiye, the most common causes of trauma-related deaths are traffic and occupational accidents.[1,2] According to the World Health Organization, 200.000 people die annually due to motor vehicle accidents, and 6 million people are injured.[3] In the United States, 20-25% of trauma-related deaths are due to thoracic trauma, resulting in approximately 16.000 deaths each year.[3,4]

Approximately one-third of trauma cases requiring hospitalization involve thoracic trauma. Early diagnosis, appropriate resuscitation, and rapid intervention can significantly reduce mortality in these patients.[5] Thoracic trauma most commonly occurs due to motor vehicle accidents, stab wounds, and gunshot injuries. In Turkiye and our region, thoracic trauma due to traffic accidents is increasingly common. One of its most prevalent consequences, pneumothorax (PTX), has been reported at varying rates between 20% and 35% in different series, depending on the severity of the trauma.[6,7]

Conventional diagnostic methods for PTX include chest X-ray (CXR) and computed tomography (CT), with CT being considered the gold standard.[6] However, ultrasound (USG) is increasingly utilized and recommended in guidelines due to its advantages, such as being radiation-free, non-invasive, and rapidly applicable at the bedside.[8,9] First used for PTX diagnosis by Wemeck et al.[8] in 1987, USG has gained attention for its effectiveness in early diagnosis.

This study aims to evaluate the effectiveness of USG in diagnosing traumatic PTX by comparing it with CT, which is accepted as the gold standard.

METHODS

Study Design and Scope

This thesis study was conducted on patients who presented to the emergency department of Ankara Atatürk Training and Research Hospital due to thoracic trauma between June and July 2013. The study was conducted before 2020, and institutional approval was obtained. All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki. The inclusion criteria covered 116 patients who underwent an USG examination for PTX evaluation as part of the E-FAST protocol in the trauma room upon hospital admission, followed by CXR and thoracic CT.

Exclusion Criteria

Patients who were not included in the study were:

Those who had no detectable cardiac activity upon hospital arrival,

Those who did not undergo thoracic CT due to lack of indication,

Those who presented with iatrogenic thoracic trauma,

Those who had a chest tube placed based on physical examination, USG, and CXR findings, thereby not undergoing thoracic CT.

Ultrasound (USG) Application Protocol

For approximately two years, bedside USG has been performed in trauma patients by emergency medicine residents trained in USG at our hospital. In this study, a Mindray UMT-200 USG device with a 7.5 MHz linear probe was used for PTX detection.

During the evaluation, the second and fourth intercostal spaces in the midclavicular line of both hemithoraces were examined. In M-mode imaging, patients who exhibited the absence of the "seashore sign" were diagnosed with PTX. After diagnosis, patients underwent CXR and, when indicated, thoracic CT.

Data Collection and Evaluation

Patients included in the study were retrospectively analyzed based on the following parameters:

Gender,

Age,

Type of trauma,

Etiology of trauma,

Associated injuries.

USG findings were compared with the interpretations of CXR and thoracic CT images by radiology specialists.

Statistical Analysis

The data analyses were performed using SPSS version 17.0. Categorical variables were presented as frequency and percentage, while continuous variables were expressed as mean±standard deviation (or median, minimum–maximum where appropriate). The Chi-square test was used to compare CT and gender. Normality analysis was performed for continuous variables; since age exhibited a non-parametric distribution, the Mann-Whitney U test was used. Taking CT as the gold standard, the diagnostic values of USG and CXR were compared by calculating their sensitivity and specificity. A p-value of <0.05 was considered statistically significant for all tests.

RESULTS

Demographic and Clinical Characteristics

Of the 116 patients included in the study, 35 (30.2%) were female and 81 (69.8%) were male, with a mean age of 44±20 years. Blunt trauma was present in 113 cases (97.4%), while 3 cases (2.6%) had penetrating trauma. All patients with penetrating chest trauma were male. The most common causes of trauma were falls from height (46.6%) and motor vehicle accidents (40.5%), followed by occupational accidents (5.2%), stab wounds (2.6%), pedestrian-vehicle accidents (2.6%), and assaults (2.6%) (Table 1).

Table 1. Trauma etiology

Cause of presentation	Number	Percentage %
Fall	54	46.6
Motor vehicle accident-passenger	47	40.5
Work accident	6	5.2
Sharp-penetrating object injury	3	2.6
Motor vehicle accident-pedestrian	3	2.6
Physical assault	3	2.6

Associated Injuries

The most frequently observed additional injury due to trauma was head trauma, found in 24 patients (20.7%). Upper extremity injuries were present in 12 patients (10.3%), lower extremity injuries in 4 patients (3.4%), vertebral injuries in 2 patients (1.7%), and abdominal injuries in 1 patient (0.9%) (Figure).

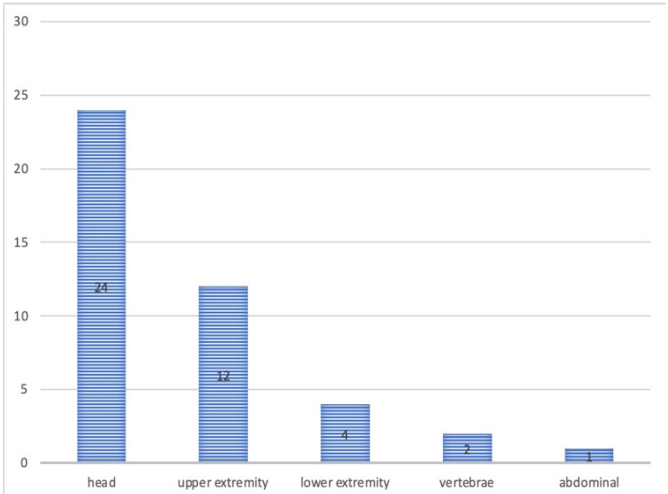

Figure. Additional injuries

Pneumothorax Detection and Comparison of Diagnostic Methods

Thoracic CT, accepted as the reference test, detected PTX in 15 of the 116 cases (13%). USG correctly identified PTX in 11 of the 15 cases detected by CT and also correctly classified 101 cases as normal. The sensitivity of USG was calculated as

73.3%, specificity as 100%, and overall accuracy as 96.5%. The average application time ranged from 2 to 3 minutes (Table 2).

Table 2. USG sensitivity and specificity

	Chest CT PTX					
	No	Yes	Sensitivity	Specificity	Accuracy rate	Kappa value
USG PTX						
No	101	4	73.3%	100%	96.5%	82.7%
Yes	0	11				

USG: Ultrasound, CT: Computed tomography, PTX: Pneumothorax

On the other hand, CXR was insufficient for PTX diagnosis, as it failed to detect PTX in any of the 15 cases identified by CT. However, CXR correctly classified 101 cases as normal, which had also been confirmed as normal by CT. The sensitivity of CXR was 0.0%, specificity was 98.7%, and overall accuracy was 87.1% (Table 3).

Table 3. Chest X-RAY sensitivity and specificity

	Chest CT PTX					
	No	Yes	Sensitivity	Specificity	Accuracy rate	Kappa value
X-RAY PTX						
No	101	15	0.0%	98.7%	87.1%	-
Yes	0	0				

CT: Computed tomography, PTX: Pneumothorax

DISCUSSION

The early diagnosis of traumatic chest injuries, particularly the rapid identification of PTX, is a crucial part of clinical management. PTX is a common condition following trauma and can lead to serious complications if not promptly addressed. Traditional diagnostic methods, such as CXR and CT, have been predominant; however, USG has increasingly been used in recent years as a fast, non-invasive, and radiation-free alternative.[8,9]

A study conducted in Turkiye showed that traumatic chest injuries were divided into 20-40% penetrating injuries and 60-80% blunt injuries.[10] Our study's findings do not align with the literature, and this could be attributed to the fact that our study was conducted in a non-specialized hospital and also due to the absence of a dedicated chest surgery unit at our center.

In our study, the most common trauma etiology was falls (46.6%), followed by traffic accidents (40.5%). Literature reports traffic accidents as the most common etiology at 31.3%.[11] In our case, falls and traffic accidents accounted for 93.2% of cases. This can be explained by the fact that our center typically receives multi-trauma patients rather than isolated chest trauma cases, such as those from stab or cut injuries.

In the study by Çobanoğlu et al.,[12] the most common accompanying injuries to chest trauma were extremity injuries (25.4%) and abdominal injuries (7.2%). Head injuries were observed in 10% of cases. In contrast, our study found that head trauma (20.7%) and extremity injuries (13.7%) were the most frequent accompanying injuries. Spinal injuries (1.7%) and abdominal injuries (0.9%) were less commonly observed. These findings are consistent with the general trend in the literature, indicating that chest trauma is typically associated with multi-trauma, and the frequency of accompanying injuries may vary.

The evaluation of the chest with USG has gained prominence in recent years and is now included in the ATSL guidelines for diagnosing conditions such as pleural effusion, hemothorax, and PTX. The first use of US for PTX detection was published in 1986 in a veterinary journal, followed by Wemeck et al.'s[8] 1987 study, which demonstrated the use of US in PTX detection. A large study conducted in 2001 evaluated 382 chest trauma patients using US, correctly identifying 37 out of 39 PTX cases, resulting in a sensitivity of 94%. False-negative results were attributed to subcutaneous emphysema, with no false-positive cases observed.[13] In a 2004 study by Knutson et al.,[14] US was shown to be a highly effective method for PTX detection with a specificity of 99.7%. US also plays a valuable role in penetrating trauma cases.

In a study by Nandipati et al.[15] in 2011, US showed a sensitivity of 95% and specificity of 99%, yielding superior results compared to chest CT. In contrast, CXR showed a sensitivity of 79% and specificity of 99%. In our study, similar to Nandipati's findings, US showed higher sensitivity and specificity compared to CXR.

Zhang et al.[16] found that the average time required for US was 2.3±2.9 minutes, for CXR 12.4±6.7 minutes, and for chest CT 16.3±7.8 minutes, indicating that US is significantly faster. In our study, the US time was 3.0±2.0 minutes. While CXR and chest CT times were not specifically measured, taking into account the transfer and post-imaging evaluation times, it is evident that US is much quicker. Based on these findings, US is recommended for the early and accurate diagnosis of PTX in polytrauma patients.

CXR fails to correctly identify 30-40% of PTX cases.[14] In cases of occult PTX, especially under positive pressure mechanical ventilation, tension PTX can develop. In a study by Kirkpatrick et al.,[17] US showed higher sensitivity than CXR (48.8% vs. 20.9%), with both tests demonstrating high specificity (99.6% and 99.7%, respectively). In a 2020 study by Soldati et al.,[18] US identified 23 out of 25 PTX cases, with a sensitivity of 92% and specificity of 94%. CXR only detected 13 cases with a sensitivity of 52%. In our study, US had a sensitivity of 72.3%, with four out of fifteen PTX cases not detected. Unlike the studies of Kirkpatrick et al.,[17] our study did not find any false-positive results from US or CXR. CXR failed to identify PTX in all 15 cases. This suggests that CXR has limitations in detecting small pneumothoraces, which may have contributed to the lack of detection in our study. Additionally, pneumothoraces less than 2 cm in size were detected in less than 10% of CT scans in our study. At the end of the study, two patients with undiagnosed PTX required positive pressure mechanical ventilation, while the other thirteen were managed with observation.

In our study, the sensitivity of US for PTX diagnosis was found to be 72.3%, whereas CXR and CT showed a sensitivity of 0.0%, highlighting CXR's limitations in detecting small pneumothoraces. Additionally, US was shown to be a highly effective, fast, and non-invasive method for PTX diagnosis, particularly in multi-trauma patients. These findings

underscore the importance of strengthening the role of US in PTX diagnosis and its widespread use in clinical practice.

Limitations

This study has several limitations. First, being conducted in a single center may limit the generalizability of the findings. Second, USG examinations were performed by emergency medicine residents with varying levels of experience, which could affect diagnostic accuracy. Additionally, interobserver variability in ultrasound interpretation was not assessed. Finally, the relatively small sample size may have impacted the statistical power of the results. Future multicenter studies with larger cohorts and standardized training protocols are needed to validate these findings.

CONCLUSION

The study concluded that USG is an effective and reliable method for diagnosing traumatic PTX. Compared to chest CT, US has higher sensitivity and specificity, with a shorter application time, while still providing high accuracy. In contrast, the sensitivity of CXR in detecting PTX was found to be very low, highlighting the limitations of CXR in PTX diagnosis. Therefore, US can be used as a reliable and rapid alternative for PTX diagnosis in trauma patients, but it should be performed by experienced personnel to ensure accurate results. These findings support the widespread use of US in emergency departments, where quick and effective decision-making is crucial.

ETHICAL DECLARATIONS

Ethics Committee Approval

This thesis study was conducted before 2020, and institutional approval was obtained.

Informed Consent

All patients signed and free and informed consent form.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

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Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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In-flight emergency medical intervention: physicians' legal responsibilities

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ABSTRACT

Medical emergencies occurring during commercial flights raise the issue of physicians' responsibility to provide in-flight medical assistance. The increasing number of passengers, the prevalence of long-haul flights, and the rising proportion of elderly individuals traveling by air contribute to the growing frequency of in-flight medical emergencies. However, the physical constraints of the flight environment, limited medical equipment, and restricted communication capabilities complicate the intervention process. This study evaluates the management of in-flight medical emergencies, intervention procedures, and the legal responsibilities of physicians. First, the most common medical conditions encountered during flights and their management strategies are discussed. Subsequently, physicians' duty to intervene, ethical responsibilities, and legal obligations according to national and international regulations are examined. Legal frameworks such as "Good Samaritan Laws," jurisdictional ambiguities, and potential legal risks are analyzed in different countries. Standardizing in-flight medical interventions, strengthening legal protections for physicians, and enhancing the capacity for emergency medical response on aircraft are of critical importance. In particular, developing pre-flight risk assessment mechanisms, regulating flight restrictions based on medical conditions, and reinforcing collaboration between airline companies and health authorities are essential. Additionally, expanding educational programs to raise physicians' awareness of aviation medicine and integrating technological solutions to support in-flight medical interventions are among the strategies that could enhance patient safety and intervention efficacy.

Keywords: Air travel, emergency, medical, first aid, physicians, legal liability

INTRODUCTION

A call for a doctor at high altitude can be an anxiety-inducing situation for any physician. The growing airline industry in an increasingly globalized world, coupled with rising flight numbers, an increasing proportion of elderly passengers, and the prevalence of long-haul flights, has led to a higher frequency of medical emergencies requiring urgent intervention during air travel.[1,2] Due to the severity of these cases, timely intervention and effective management are crucial. Therefore, physicians providing medical assistance on board must carefully consider the ethical and legal responsibilities they may encounter.

Determining the true incidence of in-flight medical emergencies is challenging due to the lack of standardized identification, classification, mandatory reporting, and a reliable database.[3] A North American study based on data from a ground-based medical consultancy company estimated that an in-flight medical emergency occurs once in every 604 flights (or 16 incidents per million passengers).[1] Another study conducted in Europe analyzed medical records from a single airline over a two-year period and reported 1.312 incidents among 10.1 million passengers (approximately one incident per 7.700 passengers).[4] Meanwhile, the United Kingdom government, using data from various organizations, estimated that a medical incident occurs in one out of every 14.000 passengers but emphasized that inconsistencies across datasets make it difficult to determine the actual incidence.[5]

Although in-flight medical emergencies vary in nature, some conditions are more frequently encountered than others. These include loss of consciousness, seizures and other neurological conditions, allergic reactions and anaphylaxis that can cause respiratory distress, acute cardiovascular events such as heart attack and angina pectoris, gastrointestinal issues such as nausea, vomiting, and diarrhea, complications related to diabetes, and systemic problems like deep vein thrombosis. Pre-existing medical conditions, the physiological stress of air travel, dehydration, and the use of alcohol or medication are contributing factors that may increase the risk of these emergencies.[1,6,7]

The flight environment presents multiple challenges that complicate diagnosis, intervention, and treatment for physicians.[8] Aerospace medicine serves as a fundamental discipline offering guidance on the physiological, environmental, and psychological effects encountered during flight, as well as the limitations associated with in-flight emergency medical interventions.[9] The management of in-flight medical emergencies is not solely the responsibility of aerospace medicine specialists; other physicians on board may also be required to take critical actions. Physicians without specialized training in aerospace medicine may have to rely on their general medical knowledge and experience in such situations. However, these interventions become more complex due to the physical and operational constraints of the flight environment. Limited cabin space, inadequate medical equipment, variations in cabin pressure, and communication barriers necessitate rapid and critical decision-making.[6,10]

Additionally, reduced cabin pressure during flight can lead to hypobaric hypoxia, while high-altitude stress factors may impair both the passenger's and the physician's decision-making abilities.[11] Under these constrained conditions, physicians must possess extensive medical knowledge and experience while maintaining composure. The standards published by the International Civil Aviation Organization (ICAO) provide essential guidelines shaping physicians' capabilities in in-flight medical interventions and aim to minimize inadequacies in medical assistance.[9] Physicians providing medical support during flights must stay informed about national and international aviation regulations and ensure legal protection for themselves.

There is limited literature regarding the legal obligations and protective measures available to physicians responding to medical emergencies in-flight. This review aims to analyze the legal responsibilities physicians may face during air travel-related medical emergencies and to provide an analytical assessment from the perspective of both national and international regulations. Datat sources fort this study include peer-reviewed journal articles, aviation regulatory guidelines, and legal statutes from multiple jurisdictions. The review focuses on research reported in the literature over the last 20 years.

IN-FLIGHT MEDICAL EMERGENCIES: INCIDENCE, CHARACTERISTICS, AND INTERVENTION REQUIREMENTS

Extensive research in the field of aviation has demonstrated that medical emergencies during flights are a common occurrence. A meta-analysis of 18 different studies covering approximately 1.5 billion passengers found that an average of 18.2 medical incidents occur per million passengers. Additionally, the overall mortality rate due to all causes was reported as 0.21 per million passengers.[12] Furthermore, approximately 11.1 out of every 100.000 flights are forced to divert due to medical reasons, with the cost of these unexpected diversions ranging from $15.000 to $893.000.[12]

Over a one-year period, data from 131,890 domestic and international flights documented that more than 27 million passengers traveled. During this time, an average of 296 medical incidents occurred per month, totaling 3.555 cases annually. The probability of encountering a medical event during a flight was estimated at approximately 1:40, corresponding to an incidence rate of 2.7%. The most frequently reported in-flight medical emergencies were loss of consciousness (37%) and suspected cardiovascular events (12%).[13] Among the 915 emergency cases recorded throughout the year, six resulted in death. However, the proportion of flights requiring diversion due to medical emergencies was less than 0.016% of total flights. Suspicion of a cardiac event was identified as the primary cause in 52% of cases requiring flight diversion.[13]

Studies have shown that the most common in-flight medical emergencies include syncope, respiratory distress, cardiac issues, and neurological disorders. Fainting and syncope rank among the most prevalent medical emergencies during air travel.[14,15] Life-threatening conditions such as deep vein thrombosis, anaphylactic shock, myocardial infarction, and hemorrhagic or ischemic stroke are also frequently reported.[1,14] Alongside these, gastrointestinal emergencies such as diarrhea, nausea, and vomiting, as well as conditions like hypertension and headaches, are commonly observed.[14] These findings highlight that in-flight medical interventions are common but often under-documented.[16]

Several factors, including the confined space within aircraft, limited availability of essential medical equipment, pressure variations, and communication challenges, significantly hinder physicians' ability to intervene and manage medical conditions effectively.[6,14] These restrictive conditions and high-stress environments necessitate composure, rapid decision-making, and a high level of professional expertise from physicians. Under these demanding circumstances, it is crucial for physicians to apply their comprehensive medical knowledge and experience, utilize effective communication skills, and maintain a calm demeanor. The limited resources available on board and the urgent need for rapid intervention require physicians to maximize their clinical competence.

EMERGENCY MEDICAL EQUIPMENT AND INTERVENTION CAPACITIES ON AIRCRAFT

The availability of emergency medical equipment and intervention capabilities on aircraft significantly impacts physicians' ability to manage in-flight medical emergencies. International civil aviation authorities, such as ICAO and the International Air Transport Association (IATA), have established regulations regarding the standard emergency medical kits required on aircraft.[14] Essential equipment typically includes oxygen systems, manual resuscitation devices, automated external defibrillators (AEDs), medications, intravenous fluids, consumables, and other medical supplies.[6,14]

However, the unique conditions of the flight environment can influence both the use of medical equipment and the effectiveness of medical interventions. Cabin pressure is typically maintained at an altitude equivalent of 6.000 to 8.000 feet, which may reduce passengers' blood oxygen levels below normal. This physiological change poses a significant risk, particularly for individuals with pre-existing respiratory or cardiovascular conditions.[17] Additionally, factors such as low humidity levels, confined spaces, and high ambient noise within the aircraft can complicate medical interventions. For example, auscultation using a stethoscope may be ineffective due to background noise, and basic assessments such as blood

pressure measurement may become challenging. Similarly, although in-flight oxygen supplementation is available, its flow rate may be insufficient to ensure adequate oxygenation for some patients.[17]

Regulations in the United States mandate that airlines permit passengers to use personal portable oxygen concentrators, but there is no standardized policy governing the provision of in-flight medical oxygen.[18] Cabin crew members are responsible for initiating first aid, but the assistance of healthcare professionals on board is crucial. Physicians must be well-prepared to handle in-flight medical emergencies to ensure patient safety. Familiarity with the available medical equipment on aircraft is essential for physicians to perform effective and appropriate interventions during emergencies.[14]

To enhance collaboration and coordination between physicians and airlines, specialized training programs should be developed. These programs should cover basic life support, the use of in-flight medical equipment, aviation physiology, and crisis communication skills. Simulation-based training can be particularly beneficial in improving emergency response capabilities. Additionally, the integration of telemedicine systems would allow in-flight physicians to consult ground-based specialists, facilitating better medical decision-making. The incorporation of telemedicine technology could play a critical role in optimizing the use of onboard medical resources and improving patient outcomes in critical cases.

LEGAL RESPONSIBILITIES OF PHYSICIANS: NATIONAL AND INTERNATIONAL REGULATIONS

Physicians' willingness, confidence, and concerns regarding providing medical assistance on board may be influenced by various factors. These include the physician's specialty not being relevant to the emergency, a retired or elderly physician having lost clinical practice, flight anxiety, or a lack of self-confidence. Additionally, the limited availability of medical equipment on board and the restrictive transport conditions of certain medications can further complicate the process. Moreover, the ambiguity of legal liabilities and ethical responsibilities may contribute to physicians' reluctance to intervene. A study has shown that concerns over medical malpractice lawsuits significantly reduce physicians' willingness to provide medical assistance, with 50% of them expressing hesitation due to potential legal repercussions.[19]

Physicians who provide medical assistance during flights are subject to legal obligations under both their national aviation laws and international regulations.[20] Organizations such as ICAO and the IATA have established guidelines defining the responsibilities and authority of physicians in in-flight medical emergencies. However, the scope of legal protections varies significantly from country to country, and existing legal gaps may pose substantial risks for physicians.[15] In this context, it is crucial for physicians to carefully assess not only their legal obligations regarding medical assistance but also the ethical and legal risks they may encounter when intervening during a flight.

Various countries, such as the United States America and Canada have enacted "Good Samaritan Laws" and similar regulations to provide certain legal protections for physicians who voluntarily render medical aid.[20] These laws aim to shield physicians from liability for interventions performed in good faith.

On the other hand, physicians who refuse to provide medical assistance in an emergency may, under certain conditions, be held legally accountable.[20] For instance, in the European Union and Australia, physicians are legally required to assist in emergency medical situations.[21] However, international law does not provide a consistent legal framework on this matter. Therefore, it is essential for physicians to carefully evaluate their decision not to intervene in in-flight emergencies and to act with consideration of all possible scenarios. Medical interventions in emergency situations hold a unique legal position, particularly concerning exceptions to the requirement of obtaining patient consent.

In Turkiye, the legal obligations of physicians regarding emergency interventions outside hospital settings are defined by various regulations. Article 5 of the Turkish Medical Association Code of Professional Ethics for Physicians emphasizes that a physician's primary duty is to protect human life. Article 10 states that, regardless of their field of expertise, physicians must provide first aid in emergency situations where necessary medical interventions are unavailable.[22]

Similarly, article 3 of the Medical Deontology Regulation mandates that physicians provide first aid in cases where adequate care is unavailable, unless exceptional circumstances prevent them from doing so.[23] According to Supplementary Article 11/2 of the Fundamental Law on Health Services (Law No 3359), emergency healthcare services must be delivered by authorized personnel. Unauthorized medical interventions in such situations are subject to legal sanctions.[24]

Additionally, articles 83 and 98 of the Turkish Penal Code state that failing to provide necessary assistance in emergencies can lead to serious legal consequences. If such negligence results in death or severe harm, it may be punishable by imprisonment.[25]

The patient rights regulation (dated 01.08.1998 and numbered 23420), in article 24, explicitly states that in life-threatening emergencies or situations where an organ is at risk, patient consent is not required.[26] However, in such cases, healthcare professionals must assess the patient's level of consciousness and the urgency of the situation before proceeding with an intervention. Moreover, for unconscious patients, the principle of presumed consent is generally applicable. Legally, the conditions for intervention may be relaxed to accommodate the urgency of the situation.[20]

JURISDICTIONAL CONFLICTS AND UNCERTAINTIES IN PRACTICE

One of the most complex aspects of international law is determining which country's legal framework governs a physician's medical intervention during a flight.[15] Multiple factors, including the country in which the aircraft is registered, the nationality of the airline, the airspace where the incident occurs, and the citizenship of both the patient and the physician, play a role in establishing the competent jurisdiction.[15] This ambiguity may lead to confusion regarding which country's medical standards and legal responsibilities the physician must adhere to. For instance, a medical intervention that is legally permissible in a

physician's home country may not be lawful in the country where the aircraft is registered.[20] Such discrepancies can expose physicians to legal risks and cause hesitation in providing medical assistance.[10]

In international flights, variations between different legal systems further complicate jurisdictional issues. As a result, a physician's legal responsibility for an in-flight medical intervention should be assessed based on the specific circumstances of the case. Physicians who provide medical assistance during a flight must also consider legal protections against allegations of negligence. In the United States, the Aviation Medical Assistance Act of 1998 grants legal immunity to physicians assisting in in-flight medical emergencies, except in cases of gross negligence or willful misconduct. Similarly, some airlines provide legal protection for physicians who intervene in medical emergencies; however, these assurances are not universally applicable.[7]

Providing emergency medical assistance during a flight presents a range of ethical and professional dilemmas for physicians.[10] Although Good Samaritan Laws are designed to protect physicians who provide medical aid in good faith, their scope and enforcement vary significantly across different jurisdictions.[10,14] The constraints of in-flight medical equipment, the limited ability to establish a definitive diagnosis, and the necessity to make rapid decisions under stressful conditions may challenge physicians' ability to uphold professional medical standards.[6,14]

Moreover, the potential consequences of the intervention and concerns about legal liability can influence a physician's decision-making process.[10] Physicians may feel morally obligated to assist patients in accordance with the Hippocratic Oath, yet they may hesitate to intervene due to inadequate medical resources and potential legal risks. This creates an ethical dilemma, requiring physicians to make swift and well-considered decisions under pressure.

CONCLUSION

The establishment of standardized international protocols, guidelines, and legal frameworks for in-flight medical emergencies is essential for ensuring the protection of both physicians and passengers. Such frameworks should eliminate jurisdictional ambiguities, clearly define physicians' responsibilities and rights, and promote consistency in the application of Good Samaritan Laws. Additionally, the medical equipment required on aircraft should be reviewed and updated to align with evolving standards. These protocols and guidelines should be integrated into training programs for both physicians and cabin crew members.

Physicians' preparedness for in-flight medical emergencies is crucial for passenger safety. Given the unique challenges of in-flight medical interventions, including resource limitations and high-stress conditions, physicians should receive specialized training. These training programs should cover basic life support, emergency protocols, the use of onboard medical equipment, and coordination with airline personnel. Furthermore, regular refresher courses should be implemented to ensure physicians remain updated on in-flight emergency procedures.

To enhance communication and coordination between physicians and cabin crew, simulation-based training and joint emergency drills should be conducted. Additionally, telemedicine systems can be integrated to provide real-time consultation between in-flight physicians and ground-based specialists. Such technologies could significantly enhance medical decision-making and optimize the use of onboard medical resources during critical incidents.

Considering these factors, it is evident that aviation authorities must introduce comprehensive regulatory frameworks, and airlines should assume greater responsibility for in-flight medical emergencies.

In summary, the effective management of in-flight medical emergencies is critical for passenger safety, and a thorough understanding of physicians' legal and ethical responsibilities is essential. Physicians must be well-informed about their national and international legal obligations, demonstrate composure and professionalism, make rapid and informed decisions, and efficiently utilize onboard medical resources. This approach is fundamental to ensuring flight safety and preventing potential legal complications.

ETHICAL DECLARATIONS

Referee Evaluation Process
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Conflict of Interest Statement
The authors have no conflicts of interest to declare.

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Author Contributions
All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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Case Report

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Vortioxetine-induced toxic hepatitis: a case report

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ABSTRACT

A 43-year-old male presented to the emergency department with complaints of abdominal pain and nausea. The patient had been on vortioxetine 20 mg daily for one year due to a diagnosis of depressive disorder. Laboratory findings revealed elevated liver enzymes, and other etiologic factors were excluded. The patient was diagnosed with toxic hepatitis and was admitted to the gastroenterology department for further management.

Keywords: Vortioxetine, toxic hepatitis, antidepressant

INTRODUCTION

Vortioxetine is a serotonergic antidepressant commonly used in the treatment of major depressive disorder. According to the literature, it is associated with low rates of mild serum aminotransferase elevations during therapy and has not previously been linked to clinically significant acute liver injury. However, in this case, we report that long-term use of vortioxetine may be associated with acute toxic hepatitis.[1]

CASE

A 26-year-old male presented to the emergency department with abdominal pain and nausea. His medical history was notable for a prior appendectomy and ongoing treatment with vortioxetine 20 mg/day for the past year due to depression. Physical examination revealed mild tenderness in the right upper quadrant. Initial laboratory tests demonstrated the following values: WBC 11.43 x10^9/L, platelet count 271 x10^9/L, INR 1.1, AST 179 U/L, ALT 171 U/L, ALP 109 U/L, GGT 435 U/L, total bilirubin 1.16 mg/dl, direct bilirubin 0.4 mg/dl, and albumin 5 g/dl. Follow-up labs obtained 8 hours later showed progressive elevation: AST 469 U/L, ALT 420 U/L, GGT 586 U/L, total bilirubin 2.09 mg/dl, and direct bilirubin 1.0 mg/dl, while INR and ALP remained stable.

Imaging with abdominal ultrasonography and contrast-enhanced computed tomography revealed normal hepatic parenchyma and biliary anatomy. Viral and autoimmune hepatitis panels were negative. The patient denied alcohol use and had no history of exposure to other hepatotoxic agents. A diagnosis of toxic hepatitis was made. Vortioxetine was discontinued, and the patient was treated with intravenous acetylcysteine (1200 mg/day) and supportive care.

DISCUSSION

Toxic hepatitis is frequently caused by medications or herbal supplements and may present with a spectrum ranging from mild transaminase elevations to acute liver failure.[2] Drug-induced liver injury (DILI) is a rare but potentially severe condition associated with significant morbidity and mortality. Genetic predisposition and environmental factors contribute to individual susceptibility. Although long-term vortioxetine therapy has been associated with aminotransferase elevations in less than 1% of patients, these are generally mild, asymptomatic, and reversible without drug discontinuation.[1]

To date, no published reports have described acute liver injury with jaundice directly attributed to vortioxetine. However, data on its hepatic safety profile remain limited. Notably, other selective serotonin reuptake inhibitors (SSRIs) have been implicated in rare cases of clinically significant hepatotoxicity.[3]

CONCLUSION

This case suggests that vortioxetine, although generally considered hepatologically safe, may be a potential cause of drug-induced liver injury in susceptible individuals.

ETHICAL DECLARATIONS

Informed Consent

The patient signed and free and informed consent form.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement
The authors have no conflicts of interest to declare.

Financial Disclosure
The authors declared that this study has received no financial support.

Author Contributions
All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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