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Review Article	5000	200	50	6	10 or total of 20 images
Case Report	1500	200	10	No tables	10 or total of 20 images
Letter to the Editor	500	N/A	5	No tables	No media
Scientific letter	900	N/A	10	No tables	2 or total of 4 images
Clinical Imaging/ Visual Diagnosis	400	N/A	5	No tables	3 or total of 6 images
History	900	N/A	10	No tables	3 or total of 6 images
Publication ethics	900	N/A	10	No tables	No media

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Steroid Injection Versus Open Surgery in the Treatment of De Quervain's Tenosynovitis

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Abstract

Aim: This study aimed to compare steroid injection and open surgery in the treatment of De Quervain's tenosynovitis.

Materials and Methods: Between January 2013 and April 2015, a total of 82 patients (65 females, 17 males; mean age=40.3 years; range, 20 to 71 years) who were admitted were included retrospectively. The patients were assigned into two groups, including group I undergoing open surgery, and group II receiving steroid injections. The rates of recurrence and satisfaction were evaluated. The patients undergoing surgery were also evaluated for the wound site infection, nerve injury, wound opening, and limited range of motions of the joints. The patients receiving steroid injections were evaluated for subcutaneous atrophy, fat necrosis, weakening or rupture of tendons, and depigmentation.

Results: The mean follow-up was 12 months (range: 6 to 22). Recurrence occurred in eight patients (20%) in the steroid injection group; however, no recurrence was seen in patients undergoing open surgery. Satisfactory or very satisfactory results were achieved in all patients in the surgery group (p=0.04). There were no complications in both groups.

Conclusion: Although steroid injection is a therapeutic option in De Quervain's tenosynovitis, open surgery appears to be a more beneficial method with relatively low recurrence and complication rates.

Keywords: De Quervain's tenosynovitis, open surgery, steroid injection

Introduction

De Quervain's tenosynovitis is one of the most common forms of stenosing tenosynovitis encountered by hand surgeons. This tenosynovitis was first described by De Quervain (1). De Quervain's tenosynovitis causes radial wrist pain that increases with activity (2). Steroid injection into the tendon sheath is a standard method as a primary treatment in uncomplicated cases (3). Although steroid injection is common, complications such as subcutaneous atrophy, fat necrosis, weakening or rupture of tendons, and depigmentation have been reported after this treatment regimen (4-7). A surgical release that provides a precise and permanent solution in most cases is considered for steroid-refractory patients and for patients whose complaints last over six months (8,9). Since the rate of recurrence and complication is lower after surgical treatment, currently, it has been widely used.

In the present study, we aimed to evaluate the efficacy of open surgery versus steroid injection in patients with De Quervain's tenosynovitis.

Materials and Methods

A total of 82 patients (65 females, 17 males) who were admitted between January 2013 and April 2015 were homogeneously divided into two equal groups. There were 42 patients (35 females, 7 males) in the first group and 40 patients (30 females,

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10 males) in the second group. In the first group, open surgery was performed. In the second group, steroid injection was performed. An informed consent form was obtained from each patient. The study was approved by the Necmettin Erbakan University Meram Faculty of Medicine Ethics Committee and was conducted in accordance with the principles of the Declaration of Helsinki (protocol no: 2017/1018).

The patients were diagnosed by medical history and positive Finkelstein test results performed during physical examination. Finkelstein test was performed to trigger the pain that occurred by the ulnar deviation of the wrist, while the thumb was being locked in the palm, and it is one of the diagnostic criteria of the disease (10,11). An X-ray was obtained from each patient to differentiate arthritis of the thumb, metacarpophalangeal joints, and scaphoid-trapezium-trapezoid joints, arthrosis of radiocarpal and intercarpal joints, and fracture of the scaphoid. Extensor pollicis brevis (EPB) entrapment test was performed to the patients with recurrent disease after steroid injection. The sensitivity of the EPB entrapment test has been reported to be 81% in identifying patients having a separate septum for the EPB tendon with the failure of corticosteroid injection (12). The test consists of two parts. First, the patient is asked to bring the metacarpophalangeal joint to the forced extension. Second, the carpometacarpal joint of the patient is abducted by the examiner in a stretched manner. Pain during the second part of the test suggests that there may be a separate compartment for the EPB (12).

All open surgeries were performed under regional intravenous anesthesia. Tourniquet was applied to all patients to identify the sensory branches of the radial nerve carefully. During surgery, an oblique or transverse skin incision was performed over the first dorsal compartment, about 1-cm proximal to the radial styloid process. To identify the sensory branches of radial nerve passing obliquely over the compartment, deep layers of the skin were gently dissected longitudinally. After the skin and subcutaneous tissue were dissected, the annular ligament was finely incised with a scalpel. The release of the tendons of abductor pollicis longus (APL) and EPB in the proximal and distal was confirmed (Figure 1). In the case of another septal formation, it was also released. After hemostasis, the skin was anatomically closed with 4/0 prolene sutures. The wound was dressed, and a bulky bandage was applied. In the early postoperative period (on day 1), the dressings of the patients were made smaller to allow wrist movements easily, and serious training was given to the patients and their relatives about the frequent mobilization to maintain the range of motion of the joints completely. In this training, it was emphasized to bring the wrist to full flexion-extension with the support of analgesics, particularly in the early postoperative period.

In patients who underwent steroid injection, the injection was performed using a dorsoradial approach as a standard procedure. First, radial styloid was found, steroid injection was performed to the distal of the APL and EPB tendons, with a 45-degree angle towards the radial styloid (Figure 2). During injection, the presence of resistance indicated that it was on the tendon; therefore, the needle was withdrawn and injected around the tendon. After injection, active/passive extension and flexion movements were initiated.

In the postoperative period, a non-steroidal anti-inflammatory drug and oral antibiotic (amoxicillin/clavulanate potassium 1 g twice a day) were prescribed for one week. Dressings were changed every three days. Sutures were removed at the postoperative second week, and the patients were examined at 6, 12, 24 weeks, and one year. The recurrence rate and satisfaction after intervention were investigated in both groups using the 10-point Visual Analogue scale. The overall satisfaction rates were evaluated according to the scores of 10:1-3 very dissatisfied; 4-5 dissatisfied; 6-7 satisfied; ≥8 very satisfied.

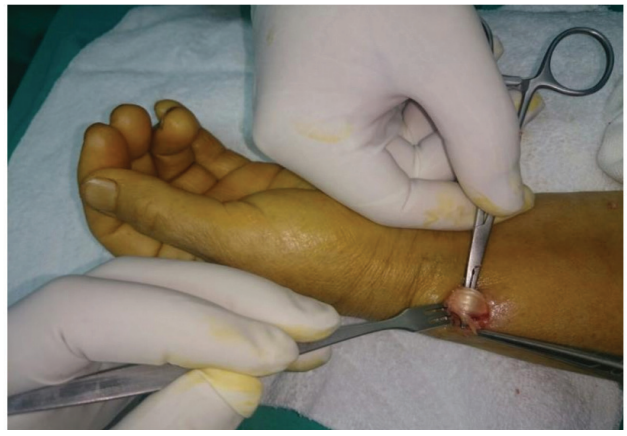

Figure 1. Release of the first dorsal extensor compartment

Figure 2. Steroid injection

Complications such as wound site infection, nerve injury, wound opening, and limited range of motions of the joints were evaluated in operated patients. Also, complications such as subcutaneous atrophy, fat necrosis, weakening or rupture of tendons, and depigmentation were evaluated in patients who underwent steroid injection.

Statistical Analysis

Statistical analysis was performed using the Number Cruncher Statistical System (NCSS) 2007 and Power Analysis, and Sample Size 2008 statistical software (NCSS, LLC; Kaysville, Utah, USA) program was used for statistical analysis. Descriptive data were primarily presented as means. A p-value of <0.05 was considered statistically significant.

Results

The mean age of the patients was 40.3 years (range: 20 to 71). Demographic and clinical data of the patients are presented in the table (Table 1).

The mean follow-up was 12 months (range: 6 to 22). In the steroid injection group, recurrence was seen in eight patients (20%). Also, the EPB entrapment test was positive in eight patients with recurrence following steroid injection.

In our study, the Trigger thumb was also present in two patients who underwent surgery. Surgery of the trigger thumb was performed in the same session. No recurrence was observed in the surgery group. No severe complication occurred in any patient. Open surgery was performed in patients with recurrence. These patients did not recur after surgery.

All of the patients who underwent surgery indicated that they were satisfied or very satisfied with the surgical treatment (p=0.04). Ten patients who underwent steroid injection indicated that they were dissatisfied or very dissatisfied. Two patients reported that they were dissatisfied due to severe pain after injection, although their complaints resolved. Eight patients were very dissatisfied due to recurrence (Table 2).

Discussion

There are many case series reporting that De Quervain's tenosynovitis is common, particularly in females, between the third and fifth decades of life. Although some reports have shown that it most commonly involves the dominant hand, the relationship with this disease has not been fully clarified yet. However, the fact that the disease is seen less frequently in males and that the dominant hand is not related to this condition are the main reasons for uncertainty in the etiology of this disease (13). In our study, consistent with previous reports in the literature, De Quervain's tenosynovitis was more common in female patients, and it most commonly affected the dominant hand. Also, the diagnosis of De Quervain's tenosynovitis is made radiographically. Ultrasonographic (USG) examinations and magnetic resonance imaging (MRI) can also be performed to identify anatomic variations in patients and to confirm the diagnosis (14,15). In our patients, USG and MRI were not performed, and the diagnosis was only based on radiographic findings with X-ray.

Many authors have suggested that the steroid injection into the tendon sheaths as the first-line treatment in De Quervain's

Table 1. Demographic and clinical data of patients

	Open surgery (n=42)	Steroid injection (n=40)
Age, mean (range)	40 (20-70)	41 (21-71)
Sex, number (%)		
Female	35 (83.3)	30 (75)
Male	7 (16.7)	10 (25)
Side, number		
Right/Left	32/10	34/6
Dominant/Non-dominant	36/6	35/5

Table 2. Patient satisfactiona

Satisfaction Rating (score distributiona)	Open surgery number (%)	Steroid injection number (%)	p-value
Very satisfied (8 to 10)	38 (90.4)	10 (25)	0.04
Satisfied (6 to 7)	4 (9.6)	20 (50)	0.04
Dissatisfied (4 to 5)	0 (0)	2 (5)	0.04
Very dissatisfied (1 to 3)	0 (0)	8 (20)	0.04

Patient satisfaction was measured by a 10-point Visual Analogue Scale (VAS)

tenosynovitis is effective. In a study conducted by Harvey et al. (16), corticosteroids were administered to the patients once or twice, and success was achieved in 80% of the patients after a nine-year follow-up period. In the study mentioned above, 10 of 11 patients in whom treatment failed, APL and EPB tendons were found to be in separate compartments during surgical release. In another study, Witt et al. (17) reported that they achieved improvement in 62% of the patients after steroid injection. In a study in which patients were followed to three years, only 12% of the patients underwent surgery after the injection (18). Overall, these study findings indicate that the tendons are in separate compartments or showed separate septations in surgical patients in whom steroid injection failed (19-22). In our study, an improvement was achieved in 80% of the patients in the steroid injection group, and 20% of them needed surgery. This finding is consistent with the literature. The EPB entrapment test was also positive in patients with recurrence, and open surgery was performed to these patients, and no recurrence was seen (12).

In the literature, it has been reported that complications may occur, such as subcutaneous atrophy, fat necrosis, weakening or rupture of tendons, and depigmentation following steroid injection for the treatment of De Quervain's tenosynovitis (4-7). In our study, no complications were seen in either group.

Furthermore, some authors have suggested that steroid injection is a part of treatment for De Quervain's tenosynovitis; however, surgical intervention should be done when the non-surgical treatments are inadequate or when the patient is expecting a rapid and precise outcome (23). In a study by Lee et al. (24), 33 patients with De Quervain's tenosynovitis underwent open surgery, and they reported that the results were very good after a six-year follow-up. Surgically, a transverse incision was used, and no complications were observed. Although the results are similar to our study, the length of follow-up time was reported in the literature.

Bouras et al. (25) reported in their series of 20 cases that the outcomes were close to perfect after open surgery, and they showed that complication was not seen using a longitudinal incision. Abrisham et al. (26) also reported that open surgery was superior, and a longitudinal incision was better than transverse incision after a five-year follow-up period. In our study, an oblique or transverse incision was used, and no complications were observed. Therefore, we suggest that, although the direction of surgical incision is critical, the attention of the surgeon also affects surgical success.

Complications such as wound site infection, nerve injury, wound opening, and limitation of range of motion of the joint can be seen following open surgery (27). Volar subluxation of tendons as a rare complication has also been reported in the literature. Altay et al. (28) performed partial excision of the extensor retinaculum during open surgery to avoid subluxation complications. They found that the results were consistent with the complete excision of the retinaculum, and no complications were observed. In our study, complete excision was performed, and no volar tendon subluxation was observed.

Study Limitations

The implications of this study are limited by its retrospective design and the relatively small number of patients.

Conclusion

In conclusion, our study results suggest that, although steroid injection is a treatment option for De Quervain's tenosynovitis, open surgery seems to be a more useful method with relatively low recurrence and complication rates.

Ethics

Ethics Committee Approval: The study was approved by the Necmettin Erbakan University Meram Faculty of Medicine Ethics Committee and was conducted in accordance with the principles of the Declaration of Helsinki (protocol no: 2017/1018).

Informed Consent: An informed consent form was obtained from each patient.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Surgical and Medical Practice: E.A., R.M., Concept: E.A., R.M., Design: E.A., R.M., Data Collection or Processing: E.A., Analysis or Interpretation: E.A., R.M., Literature Search: E.A., Writing: E.A.

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Defensive Medicine in the Emergency Department: A Cross-sectional Study from the Perspective of Emergency Medical Specialists

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Abstract

Aim: An increase in defensive medicine has recently been observed due to malpractice suits brought against physicians. This results in increased medical costs, requests for unnecessary tests, or delays in the treatment of high-risk patients.

Materials and Methods: Data were collected using an electronic questionnaire prepared by the authors following a review of the literature and sent to participants via docs.google.com. Numerical data were expressed as mean plus standard deviation, and categorical data as number and percentage. The Mann-Whitney U and Kruskal-Wallis tests were employed for data analysis.

Results: Men represented 67.9% (n=218) of the participants, and 70.7% (n=227) of our subjects were aged 24-35. In addition, 92.2% of participants considered that both consultant physicians in emergency departments (ED) and emergency physicians tended to be defensive in their approach to patients. Our findings showed that 88.1% (n=283) of participants requested more tests and consultations from patients arriving at the ED in order to avoid malpractice suits. Finally, 39.6% (n=127) of participants considered that emergency medicine specialists sought to avoid caring for complicated patients involving a greater workload in terms of tests, consultation, ED stay, and treatment.

Conclusion: Defensive medicine is a growing global phenomenon. The most undesirable and dangerous aspect of defensive medicine is that it also impacts on ED patients. The practice of ascribing every adverse patient outcome to the physician must be abandoned, and steps must be taken toward finding a solution.

Keywords: Defensive medicine, emergency department, malpractice, medical insurance

Introduction

Defensive medicine is defined as "physicians requesting additional tests in the absence of indications or else avoiding high-risk patient groups in which adverse outcomes may occur during diagnosis and treatment" (1,2).

There are two forms of defensive medicine, namely positive and negative. Positive defensive medicine involves more procedures of no or little benefit to the patient's medical status (imaging, additional tests, and consultations) being requested than are required. Negative defensive medicine is defined as the avoidance of procedures in high-risk patients in terms of survival or complications (2-5).

An increase in defensive medicine has recently been seen due to malpractice suits brought against physicians. The disproportion between physicians' earnings and compensation payments deriving from such suits inevitably harms attitudes toward patients, and this results in increased medical costs, requests for unnecessary tests, or delays in the treatment of high-risk patients (6). Defensive medicine reduces the quality of health services and leads to distrust and dissatisfaction among patients. The consequences of defensive medicine also violate patients' rights

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and medical ethics (2,7). By behaving defensively, physicians are, in effect, ignoring their legal responsibilities. Defensive medicine, encountered in almost all areas of health services, has also begun to impact on emergency department (ED) patients. Delayed admission due to consulting physicians requesting more tests and unnecessary consultations for high-risk patients in terms of survival presenting to the ED can also be included within the concept of defensive medicine (8). Having advanced tests that are non-urgent and can easily be performed after admission carried out in the ED instead can lead to delayed admission, unnecessary occupation of the ED, resource wastage, and increased morbidity and mortality.

This study investigated the defensive medicine applied to ED patients by emergency medicine specialists/residents and consultant physicians (from other departments).

Materials and Methods

Study Design

The requisite ethical committee approvals were granted for this cross-sectional study (protocol no.: BEAH KAEK 2019/11-119). Data were collected using an electronic questionnaire prepared by the authors following a review of the literature and sent to participants via docs.google.com. This questionnaire consisted of questions/propositions concerning demographic data, professional experience, a region of employment, number of patients served, and the perceptions and opinions of physicians working in the area regarding defensive medicine. Questions regarding defensive medicine were 5-point Likert type, with responses closer to 5 expressing more significant disagreement with the presence of defensive medicine. Our aim in this study was to evaluate consultant physicians' attitudes toward patients in the ED through the eyes of emergency medicine specialists/residents and to investigate tendencies to adopt defensive medicine.

Participant Selection

Three hundred and sixty-nine out of 500 emergency medicine specialists and specialist students who work in our country and whose contact information can be accessed have agreed to participate in the study. The data collection process lasted six months, at the end of which 48 questionnaires were discarded for being incomplete or carelessly completed (Figure 1). The participation rate was 86.9%.

Data Analysis

Data analysis was performed on Statistical Package for the Social Sciences version 22 software. Numerical data were expressed as mean plus standard deviation, and categorical data as number and percentage. Compatibility with normal distribution was assessed using the Kolmogorov-Smirnov test. The Mann-Whitney U and Kruskal-Wallis tests were used in the analysis of non-normally distributed numerical data. P values <0.05 were regarded as statistically significant.

Results

Men represented 67.9% (n=218) of the participants, and 70.7% (n=227) of subjects were aged 24-35. Physicians with 1-10 years' work experience constituted 86.9% (n=279) of the participants, and 53.0% (n=170) served 300-600 patients over a 24-h period. The highest level of participation was from the Eastern Anatolia region of Turkey, at 22.4% (n=72). Various sociodemographic characteristics of the participants are shown in Table 1.

We observed that 92.2% of participants considered that both consultant physicians in EDs and emergency physicians tended to exhibit defensive medicine. Emergency and consultant physicians' defensive tendencies were unaffected by variables such as age, gender, length of time in the profession, numbers of patients served in 24 h, and region of employment.

Seventy-one percent of participants (n=228) thought that the use of imaging techniques had increased following the

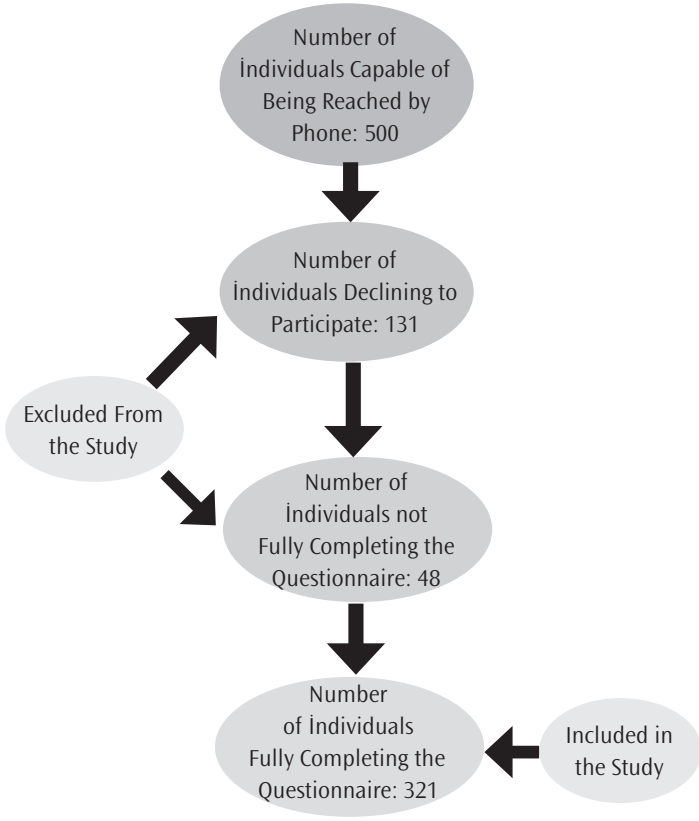

Figure 1. Flowchart: Number of people included and not included in the study

introduction of compulsory financial liability insurance against medical malpractice. Additionally, 93.1% of participants (n=299) reported that the use of computed tomography had increased. Moreover, 88.1% of participants (n=283) requested more tests and consultations for patients presenting to the ED in order to avoid malpractice suits in such departments (Table 2).

Ninety-five percent of participants (n=305) thought that consultant physicians in the ED exhibited reluctance by requesting unnecessary tests and consultations. Also, 87.6% (n=282) of participants thought that clinicians were reluctant to admit patients, even when this was indicated. Moreover, 90.3% (n=290) of participants considered that consultant physicians were reluctant to admit patients in generally poor condition, while 95.3% (n=306) thought that they preferred to complete unnecessary tests and consultations in the ED (Table 3).

In our study, 85.9% of participants (n=276) thought that internal medicine clinics exhibited the most considerable reluctance concerning consultation and admittance procedures for ED patients, and 82.8% (n=266) considered that the hospital administration was passive in intervening (Table 4).

We observed that 39.6% (n=127) emergency medicine specialists considered that there was a reluctance to care for complicated cases involving a higher workload in terms of tests, consultation, length of stay in the ED, and treatment. Also, 88.1% (n=283) of participants thought that more tests and consultations tended to be requested for ED patients (Table 5).

Seventy-six percent of respondents (n=244) reported that clinics from which they requested consultations referred patients to other clinics without seeing them, while 80.7% (n=259) reported that clinics behaved as if consultations requests were unnecessary in the case of patients whom they did see. Additionally, 55.8%

Table 1. Participants' sociodemographic characteristics

Characteristics	Number	Percentage
Age		
24-35 years	227	70.7
36-45 years	78	24.3
≥46 years	16	5.0
Gender		
Male	218	67.9
Female	103	32.1
Length of service		
1-10 years	279	86.9
11-20 years	28	8.7
>20 years	14	4.4
Number of patients served in 24 h		
300-600	170	53.0
601-1000	106	33.0
>1000	45	14.0
Region where employed		
Eastern Anatolia	72	22.4
Mediterranean	21	6.5
Aegean Coast	53	16.5
Southeast Anatolia	21	6.519.3
Central Anatolia	62	14.0
Black Sea	45	14.6
Marmara	47	

Table 2. Emergency department physicians' opinions concerning test requests for patients

Question/Proposition	Responses	Percentage	Number
The frequency of the use of imaging techniques (USG, MRI, and CT) during the diagnosis of patients in the ED was influenced by the introduction of medical liability insurance.	Definitely agree	36.4	117
	Agree	34.6	111
	Unsure	11.8	38
	Disagree	13.1	42
	Definitely disagree	4.0	13
If you think the use of imaging has increased, which technique has seen the most significant increase?	USG	4.4	14
	MRI	1.6	5
	CT	93.1	299
	X-ray	0.9	3
More tests and consultations are being requested in order to avoid malpractice suits in the ED.	Definitely agree	43.9	141
	Agree	44.2	142
	Unsure	4.4	14
	Disagree	6.9	22
	Definitely disagree	0.6	2

USG: Ultrasonography, MRI: Magnetic resonance imaging, CT: Computed tomography, ED: Emergency department

(n=179) of ED physicians considered that surgical clinics encouraged patients or families not to undergo surgery by providing misleading or dissuasive information, while 64.8% (n=208) considered that aggressive or complaining behavior by patients and/or families affected consultant physicians' attitudes toward patients (Table 6).

Table 3. Emergency physicians' opinions concerning the attitudes of consultant physicians to patients requiring consultation and hospitalization

Question/Proposition	Response	Number	Percentage
The clinicians you invite to the ED are reluctant to admit patients by requesting unnecessary tests or consultations.	Definitely agree	199	62.0
	Agree	106	33.0
	Unsure	8	2.5
	Disagree	7	2.2
	Definitely disagree	1	0.3
The clinician concerned is generally reluctant to admit even if the patient you evaluate in the ED has admission indication.	Definitely agree	140	43.6
	Agree	142	44.2
	Unsure	19	5.9
	Disagree	20	6.2
	Definitely disagree	-	-
The clinic exhibits reluctance during the admission of patients in generally poor condition from your ED.	Definitely agree	186	57.9
	Agree	104	32.4
	Unsure	22	6.9
	Disagree	8	2.5
	Definitely disagree	1	0.3
Other consultations and tests are performed in the ED for patients due to be admitted to other departments.	Definitely agree	195	60.7
	Agree	111	34.6
	Unsure	1	0.3
	Disagree	12	3.7
	Definitely disagree	2	0.6
The relevant clinic physician does not seek space for a patient considered for admission to that department from the ED. The search for space is generally left to emergency physicians.	Definitely agree	220	68.5
	Agree	74	23.1
	Unsure	12	3.7
	Disagree	14	4.4
	Definitely disagree	1	0.3

ED: Emergency department

Table 4. Emergency department physicians' opinions concerning other clinics and hospital administrations

Question/Proposition	Response	Number	Percentage
Internal medicine clinics exhibit greater reluctance in terms of consultations in the ED and of admission.	Definitely agree	177	55.1
	Agree	99	30.8
	Unsure	34	10.6
	Disagree	10	3.1
	Definitely disagree	1	0.3
The hospital administration is passive toward clinics that are reluctant in terms of consultation and admission.	Definitely agree	159	49.5
	Agree	107	33.3
	Unsure	24	7.5
	Disagree	27	8.4
	Definitely disagree	4	1.2

ED: Emergency department

Table 5. Emergency department physicians' regarding consultation procedures for complicated patients

Question/Proposition	Response	Number	Percentage
Some emergency specialists in the ED avoid caring for complicated patients (a patient group involving a greater workload).	Definitely agree	59	18.4
	Agree	68	21.2
	Unsure	52	16.2
	Disagree	109	34.0
	Definitely disagree	33	10.3
Excessive tests and consultations are requested in the ED in order to avoid malpractice suits.	Definitely agree	141	43.9
	Agree	142	44.2
	Unsure	14	4.4
	Disagree	22	6.9
	Definitely disagree	2	0.6
Procedures in the ED, such as requesting consultations, admitting patients, and seeking places for patients adversely impact on the time you spend on the telephone, taking histories, and physical examinations.	Definitely agree	223	69.5
	Agree	87	27.1
	Unsure	5	1.6
	Disagree	6	1.9
	Definitely disagree	-	-
You have to convince the consultant physician from the clinic from which consultation is requested to take care of the patient.	Definitely agree	127	39.6
	Agree	112	34.9
	Unsure	36	11.2
	Disagree	39	12.1
	Definitely disagree	7	2.2

ED: Emergency department

Table 6. Emergency health professionals' opinions concerning consultant physicians' attitudes toward emergency patients

Question/Proposition	Response	Number	Percentage
The physician from whom you request a consultation generally suggests that another clinic or clinics examine the patient, after which the physician will do so, before even seeing the patient.	Definitely agree	105	32.7
	Agree	139	43.3
	Unsure	45	14.0
	Disagree	29	9.0
	Definitely disagree	3	0.9
When the ED requests a consultation, we generally hear discouraging comments from the consultant, such as 'Why did you bother me with this? This has nothing to do with me. I have written a note on the file'.	Definitely agree	122	38.0
	Agree	137	42.7
	Unsure	40	12.5
	Disagree	21	6.5
	Definitely disagree	1	0.3
A surgeon who is reluctant to intervene encourages the patient/family to refuse surgery by providing misleading or dissuasive information.	Definitely agree	74	23.1
	Agree	105	32.7
	Unsure	82	25.5
	Disagree	55	17.1
	Definitely disagree	5	1,6
Aggressive behavior and complaints from patients and relatives in the ED make consultant physicians reluctant to care for and admit patients.	Definitely agree	79	24.6
	Agree	129	40.2
	Unsure	73	22.7
	Disagree	36	11.2
	Definitely disagree	4	1.2

ED: Emergency department

Discussion

All health workers, and particularly physicians, have employed defensive methods with which to protect themselves while engaged in their profession, based on the conditions applying at the time. Unfortunately, defensive medicine can lead to positive or negative practices by distracting practitioners away from evidence-based medicine (9). Negative defensive medicine practices include concealing or not employing high-risk therapies and diagnostic tests in order to avoid potential risks in patient care and resulting claims of malpractice (5). Positive defensive medicine involves unnecessary and excessive use of diagnostic tests and interventions by health service providers in order to minimize risks that may be encountered in health care (5). In a study of 824 specialist physicians in high-risk departments in Pennsylvania, Studdert et al. (10) reported that 93% of participants employed defensive medicine, while in their study of medical students, Rodriguez et al. (11) reported an increase in concerns over malpractice and defensive thinking as students approached graduation. In our study, 92.2% of participants considered that both consultants and emergency physicians employed defensive medicine. In their study of brain surgeons, Solaroglu et al. (12) determined that 82.4% of subjects tended to employ defensive medicine and that they were affected by sociodemographic characteristics such as age, geographical region of residence, and region of employment. In our study, however, emergency medicine specialists' dispositions to defensive medicine were unaffected by sociodemographic characteristics. We attribute the discrepancy between Solaroglu et al.'s (12) study and our own to the different specialty fields involved. Nahed et al. (13) reported that 72% of participants employed more imaging techniques due to a fear of malpractice claims (13). In this study, it was found that imaging methods increased in ED.

Although malpractice is a matter of anxiety to all health workers, it primarily concerns physicians, as being solely responsible for the patient, and leads to an increase in unnecessary consultation and test requests. These unnecessary procedures slow down health services, lower their quality, and lead to increased costs (14). Wong et al. (15) reported that due to concerns over malpractice, emergency physicians requested computed tomography for child patients even with only minor head traumas (15). In this study, tended to request more examination and consultation because of the malpractice anxiety of the emergency service workers. They may make considerable efforts to avoid even complicated patients in the poor general condition being admitted to their clinics. This defensive approach leads to loss of time and increased costs as a result of which the patient may also suffer harm (6,16,17). In a study involving radiation oncologists, Ramella et al. (18) reported that due to concerns over malpractice, 43% of participants shared documentation regarding diagnosis and treatment with colleagues and requested their opinions (18). In our study, the participants thought that the consultant physicians applied for defensive medicine by requesting unnecessary investigations and consultations from the patients in the ED.

EDs are units that operate on the 24/7 principle and where procedures are performed very quickly. Also, due to increasing patient crowding, great efforts are made to accelerate procedures in EDs still further. Both patients and families and also consultant physicians frequently take advantage of this feature of EDs. In our study, 95.3% of participants considered that consultant physicians take advantage of the rapid functioning of EDs. Also, in this chaotic environment, the task of finding space for patients admitted to clinics is left to emergency physicians. In our study, 91.6% of participants reported that physicians applying defensive medicine to patients in the ED also expected emergency physicians to undertake the task of finding space for them.

EDs are units that represent the first point of presentation for high-risk patients and that exhibit high patient turnover. ED physicians may, therefore, request more tests than necessary and seek to share risks with other clinics (19). In addition to the high density of risky patients in EDs and the stress in the working environment, emergency physicians also experience problems with professional colleagues; much time is lost due to procedures such as requesting consultations by telephone and convincing colleagues to perform them and admission or referral procedures. In our study, most participants reported being unable to devote sufficient time to patients due to unnecessary tasks and procedures in the ED.

Similarly to physicians from other branches, there is also a tendency to employ positive and negative medicine among ED physicians (6). The tendency in emergency physicians generally manifests in the form of requesting unnecessary tests and consultations. Katz et al. (20) investigated the attitudes of physicians to patients with chest pains in the ED from the perspective of malpractice fears. They observed that physicians requested more tests and consultation than necessary in order not to overlook medical conditions, and that they even admitted patients with low-risk chest pains (20). Similarly, in the present study, requested unnecessary tests and consultations due to concerns over malpractice suits.

Despite the high tendency to defensive medicine, emergency physicians still have an obligation to care for risky and complicated patients. Although specialists from other branches also have such obligations, they may still sometimes avoid assuming responsibility for patients through various delaying tactics or by referring them directly to the ED. Consultant physicians invited

to the ED sometimes request that other relevant clinics evaluate the patient and exhibit negative behaviors toward emergency physicians. In the present study, reported being subjected to reluctance or negative attitudes on the part of consultant physicians. Surgical departments may sometimes provide dissuasive or misleading information in order to persuade the patient or the family against surgery. We observed that considered that surgical clinics attempted to dissuade patients from surgery.

Study Limitations

There are several limitations to our study. First, the study data were collected using a questionnaire sent out electronically, rather than at face-to-face interviews. Also, participation in this study, which was planned on a nationwide basis, was low due to difficulties in obtaining up-to-date communication details for emergency medicine specialists and residents. Our study also involved only ED physicians and not specialists from other branches.

Conclusion

Defensive medicine is resulting in countries facing increased health spending, reduced patient satisfaction, and reduced quality of health services. This study shows that EDs are significantly affected by this medical malpractice situation. A malpractice law setting out the responsibilities of the patient, physician, and health administration must be established. EDs' working conditions and functioning must be reviewed. Public awareness activities aimed at preventing the use of EDs for other than their intended purposes and at increasing their efficiency are also needed.

Ethics

Ethics Committee Approval: The requisite ethical committee approvals were granted for this cross-sectional study (protocol no.: BEAH KAEK 2019/11-119).

Informed Consent: Consent form was filled out by all participants.

Peer-review: Externally and internally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: E.T., O.D., S.Y., Concept: E.T., O.D., S.Y., Design: E.T., O.D., S.Y., Data Collection or Processing: E.T., O.D., S.Y., Analysis or Interpretation: E.T., S.Y., Literature Search: O.D., S.Y., Writing: E.T., O.D., S.Y.

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The Predictive Value of Procalcitonin in the Prognosis of Patients with Acute Coronary Syndrome

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Abstract

Aim: The study aimed to investigate the prognostic value of serum procalcitonin (PCT) levels in patients with acute coronary syndrome (ACS).

Materials and Methods: Two hundred patients with ACS who applied to the emergency department due to chest pain and were hospitalized into the cardiology clinic of our hospital between January 2014 and December 2016 were included in this cross-sectional cohort study. The patients were divided into four groups based on their diagnosis. The first group was inferior myocardial infarction (MI), the second group was anterior MI, the third group was non-ST-elevation MI (NSTEMI), and the fourth group was high-risk unstable angina (UA). These groups were compared according to PCT, age, gender, left ventricular ejection fraction, cardiac troponin (cTn) I, three-vessel disease (TVD), and mortality rate.

Results: There were statistically significant differences between ACS groups concerning PCT values. PCT level was significantly higher in inferior MI than in anterior MI, NSTEMI, and UA groups. There were statistically significant differences between cTn positivity checked at 0^{th}, 6^{th}, and 12^{th} hours and ischemic heart failure after MI as well as between mortality and TVD. TVD and mortality were found to be significantly higher in the inferior MI group than the other subgroups. Ischemic heart failure was found to be statistically higher in anterior subgroup than the other subgroups.

Conclusion: Increased PCT level may be a marker that can be used in indicating ACS and its prognosis.

Keywords: Acute Coronary syndrome, emergency department, mortality, procalcitonin

Introduction

Acute coronary syndrome (ACS) including unstable angina (UA), non-ST-elevation myocardial infarction (NSTEMI) and ST-elevation myocardial infarction (STEMI) continue to be the main reason of mortality and morbidity all around the world despite the advancing medical technologies, many factors revealed in the ethiopathogenesis and developments in coronary artery disease (CAD) treatment. Many studies on atherosclerotic disease that has increasing prevalence are conducted and new results are obtained (1). Cardiac troponin (cTn) is quite sensitive and is a specific indicator of myocardial damage. Increased levels of cTn have importance in ACS concerning prognosis and course of the treatment. Therefore, measurements of cTn levels are often used for differential diagnosis in ACS in the emergency department (ED) and intensive care units (2-5). However, it is impossible to detect the patients with ACS who have high risk via serum troponins, because myocardial necrosis is not seen in many of these patients. Therefore, new cardiac biomarkers, which will help rapid and absolute diagnosis, are required in order for risk evaluation in the patients with ACS, before the traditional markers, which indicate myocardial cell damage and in case where these markers do not

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elevate. It is a known fact that inflammation plays a vital role in every step of atherosclerosis in the point where there are theories that have been developed and studies that have been conducted on the pathogenesis of atherosclerosis for over a hundred years. Inflammation theory is mostly accepted today (1,6-9). There are several studies for cardiac markers except for cTn today, and one of them is procalcitonin (PCT). PCT is the pre-hormone of calcitonin, which is involved in calcium homeostasis and which is normally secreted by the C cells of the thyroid glands with response to hypercalcemia under physiologic conditions (10). PCT is known to be a diagnostic marker for severe sepsis or septic shock in critically ill patients (11). In sepsis, PCT is thought to be produced by the liver and peripheral blood mononuclear cells modulated by lipopolysaccharides and sepsis-related cytokines (12). The PCT level also increases in other clinical settings such as trauma, major cardiac surgery, pancreatitis, and cardiogenic shock. There are still contrasting data about the role of PCT in patients with acute myocardial infarction in those with ACSs, which are NSTEMI or UA (13). The relationship between ACS and PCT was searched in certain studies before, but we could not find any study that searched the relationship between subgroups of ACS and PCT in the literature. We aimed to evaluate inferior, anterior myocardial infarction (MIs), which are subgroups of STEMI, NSTEMI as well as UA and PCT levels, the relationship between them and cTn, troponin level, ischemic heart failure (IHF), which is one of the most frequent complications after acute MI (AMI) with regard to three-vessel disease (TVD) and mortality, and to indicate whether PCT is a predictive marker for these cases or not in our study.

Materials and Methods

Study Design and Population

The study was prospectively conducted throughout six months. Two hundred patients with ACS applied to the ED of Sivas Numune Hospital between January 2014 and December 2016. The patients were divided into four groups, each of which consisted of 50 individuals. The first group included inferior AMI, inferolateral AMI, inferoposterior AMI and right ventricle MI; the second group included septal AMI, anterior AMI, lateral AMI, high lateral AMI and common anterior AMI; the third group included NSTEMI, and the fourth group included the patients with UA who have high risk based on the Braunwald classification (14). Patient-focused medical history, physical examination, twelve-lead electrocardiography (ECG), and chest radiography were conducted and the results were recorded. Venous blood samples were obtained from the patients to measure cardiac biomarkers and PCT levels. TVD was considered when left anterior descending artery, circumflex artery, and right coronary arteries had as at least 50% occlusion. The patients who had chest pain and/or discomfort lasting at least 30 minutes and ECG with STEMI following the American College of Cardiology Foundation (ACCF)/ American Heart Association (AHA) 2013 guideline were included in the study (15). UA/NSTEMI was defined according to the criteria of the AHA/ACCF 2014 guideline for the management of patients with non-ST-elevation ACS. All of the patients were checked through transthoracic echocardiography (TTE) to determine whether there were focal wall motion abnormalities or not. Philips Epiq 7 ultrasound machine was used for TTE in this study.

All patients gave written informed consent, and the study was approved by the Ethical Committee of Faculty of Medicine of Cumhuriyet University (date: 17/01/2018, decision no: 2018-01726).

Procalcitonin

PCT was examined via a compact automated immunoassay system (Mini Vidas®, BioMérieux, Marcy-l'Étoile, France) within 20-30 minutes. The results within 0-0.05 ng/mL were accepted as normal.

Cardiac Biomarker Analysis

Venous blood samples were obtained from the antecubital veins of the patients in order to measure serum levels of troponin I. Elecsys troponin I STAT (cobas e 411 analyzer, Roche Diagnostics GmbH, Mannheim, Germany) was used to measure troponin I levels. cTnI levels of patients were measured at 0^{th}, 6^{th}, and 12^{th} hours.

Angiographic Analysis

Percutaneous coronary intervention studies of all patients were evaluated by cardiologists who were blind to patients' clinical and cardiac marker status.

Statistical Analysis

The data obtained from this study were analysed via SPSS 20 software package. Shapiro-Wilk test was used as the test of normality. Mann-Whitney U and Kruskal-Wallis H tests were used to compare the differences between groups since the variables were non-normally distributed. The group that caused the significance was determined using multiple-comparison post-hoc test. Friedman's two-way ANOVA was used in the analysis of more than two non-normally distributed variables and multiple-comparison post-hoc test was used to detect variables that varied from each other. Chi-square analysis was used for categorical variables. Fisher's exact test was used in cases where estimated values in sources in 2x2 tables had not sufficient volume. Pearson's chi-square analysis was applied through Monte Carlo Simulation in RxC tables. The significance level was used as 0.05. $P<0.05$ was considered as statistically significant.

Results

The clinical and demographic characteristics of the patients are listed in Table 1. cTn values of inferior, anterior, and NSTEMI groups at the 0th, 6th, and 12th hours were found significantly higher than cTnI value of UA group. cTn value of the anterior group at the 12th hour was found significantly higher than the cTnI value of the NSTEMI group (Table 2). There was no statistically significant difference between ACS groups concerning PCT values. PCT level was found statistically higher in the inferior MI group

Table 1. Baseline characteristics of study patients and value distributions of variables

	Acute coronary						
	All patients	Patients with					
		IMI	AMI	NSTEMI	UA	H	p-value
Basaline characteristcis							
Age, mean ± SD, yr	63.5±9.4	64.4±8.3	63.9±10.5	63.7±9.2	62.1±9.7	1.53	0.675
Sex, Female/male	74/126	20/30	21/29	19/31	14/36	x^2=2.488	0.477
Labaratory finding							
BS, mg/dL	164±87	195±114	164±80	155±61	143±80	**9.810**	**0.020**
PCT, ng/mL	0.4±0.6	0.5±0.6	0.6±0.7	0.3±0.5	0.06±0.06	**135.2**	**0.001**
LVEF, %	48.8±12	46.7±11.8	3.3±11.6	48.8±11.3	56.6±9.4	**34.8**	**0.001**
TG, mg/dL	156±90.4	165.8±65.7	142.7±85.2	153.6±96.4	162±9.4	5.801	0.121
CHOL, mg/dL	198.4±85.7	206.6±69	225.8±112.2	188.1±91.2	172.9±49.8	9.932	0.019
HDL, mg/dL	33.6±8,8	32.3±5.8	33.6±7.2	35.3±12.6	33.3±7.9	1.756	0.625
LDL, mg/dL	116,6±4.9	124,5±40	130.4±66.2	105.5±43.1	106.2±37.8	7.619	0.055
cTn 1, ng/mL	2.5±4	3.5±2.3	4.4±6.6	2.2±2.2	0.05±0.1	**113.6**	**0.001**
cTn 2	6.8±7.3	9.4±5.2	10.8±8.4	6.8±7	0.1±0.2	**119.4**	**0.001**
cTn 3	16.6±17.8	23.4±13.4	27.5±21.4	15.3±14.5	0.3±0.5	**121.1**	**0.001**
AST, IU/L	32±29	34.8±38	33.3±39.5	28.6±13.9	31.3±13.6	6.270	0.099
ALT, IU/L	32.3±34.5	33.3±41.7	35±46.3	14.6±16.2	36.4±24.6	**9.397**	**0.024**
ALP, IU/L	109.5±55.4	125±48	100.6±43.7	115.4±56.3	97.1±67.6	**17.401**	**0.001**
CK, IU/L	160.8±109.4	149.4±67.2	158.3±160.2	173.1±98.1	162.6±92.2	4.325	0.228
CKMB, IU/L	32.5±20.8	33.9±20.2	30.4±25.4	34±17.9	31.6±19.3	3.693	0.297
WBC, 10^3/UL	10.8±3.5	9.89±3.25	10.2±3.7	11.3±3.1	11±3.8	3.357	0.340
hsCRP, mg/dL	5.3±5.3	7.4±5.8	5.7±5	4.6±5.8	3.5±3.9	26.080	0.001

IMI: Inferior myocardial infarction, AMI: Anterior myocardial infarction, NSTEMI: Non-ST elevation myocardial infarction, UA: Unstable angina, BS: Blood suger, PCT: Procalcitonin, LVEF: Left ventricular ejection fraction, TG: Triglycerides, CHOL: Cholesterol, HDL: High density lipoprotein, LDL: Low density lipoprotein, SD: Standard deviation, cTn: Troponin, AST: Aspartate aminotransferase, ALT: Alanine aminotransferase, ALP: Alkaline phosphatase, CK: Creatine kinase, CKMB: Creatine kinase-MB, WBC; White blood cell, hsCRP: High-sensitivity C-reactive protein, yr: year, p<0.05

Table 2. Chi-square analysis of varieties of Acute Coronary syndrome according to variables

Acute Coronary syndrome							
		IMI n (%)	AMI n (%)	NSTEMI n (%)	UA n (%)	$\chi 2$	p-value
Gender	**Female**	20 (10)	21 (10.5)	19 (9.5)	14 (7)	2.488	0.477
	Male	30 (15)	29 (14.5)	31 (15.5)	36 (18)		
Complication	**No**	22 (11)	19 (9.5)	23 (11.5)	41 (20.5)	**21.597**	**0.001**
	Yes	28 (14)	31 (15.5)	27 (13.5)	9 (4.5)		
TVD	**No**	22 (11)	33 (16.5)	39 (19.5)	41 (20.5)	**10.759**	**0.013**
	Yes	28 (14)	17 (8.5)	11 (5.5)	9 (4.5)		
Mortality	**No**	40 (20)	46 (23)	47 (23.5)	49 (24.5)	**29.963**	**0.001**
	Yes	10 (5)	4 (2)	3 (1.5)	1 (0.5)		

IMI: Inferior myocardial infarction, AMI: Anterior myocardial infarction, NSTEMI: Non-ST elevation myocardial infarction, TVD: Tree-vessel disease, UA: Unstable angina

than MI, NSTEMI, and UA groups. Left ventricular ejection fraction (LVEF) levels were found statistically lower in the inferior MI, anterior MI, and NSTEMI groups than the UA group. There was no statistically significant difference between cTnI positivity, which as checked at the 0th, 6th, and 12th hours and IHF, which occurred after AMI, as well as between mortality and TVD (Table 3). There was no statistically significant difference based on PCT and concerning progressing IHF, TVD, and mortality (Table 3). In terms of PCT, ACS, TVD, IHF, mortality, and cTn levels were found as a prognostic symptom in univariate analysis. Gender, age, and blood glucose levels were statistically insignificant. However, in multivariate linear regression analysis with the advanced staged method, ACS, TVD, and IHF were associated with increased CAD risk after adjustment for statistically significant variables in univariate analysis (Table 4). In terms of mortality, ACS, TVD, IHF, PCT, and gender were found as prognostic factors in univariate analysis. Age, cTn, and blood glucose levels were statistically insignificant. However, in multivariate linear regression analysis with the advanced staged method, ACS, TVD, PTC, and IHF were associated with increased CAD risk after adjustment for statistically significant variables in univariate analysis (Table 5).

Table 3. Analysis of the variables that develop after acute coronary syndrome according to troponin and procalcitonin levels

			Troponin levels				Proclacitonin levels			
			n	SD	Z	p-value	SD	Z	p-value	
Ischemic heart failure	0. h cTn	No	105	1.4±1.9	-5.889	0.001	No	0.28±0.52	-2.97	0.003
		Yes	95	3.8±5.2						
	6. h cTn	No	105	4.4±5.7	-5.547	0.001				
		Yes	95	9.4±8.0						
	12. h cTn	No	105	10.7±13.1	-5.654	0.001	Yes	0.45±0.61		
		Yes	95	23.2±19.9						
Mortality	0. h cTn	No	182	2.0±2.3	-4.514	0.001	No	0.31±0.53	-5.64	0.001
		Yes	18	7.7±9.9						
	6. h cTn	No	182	5.8±5.6	-4.212	0.001				
		Yes	18	16.7±12.8						
	12. h cTn	No	182	14±13.8	-4.553	0.001	Yes	0.93±0.69		
		Yes	18	43.5±28.8						
Three-vessels disease	0. h cTn	No	135	2.1±4.4	-4.381	0.001	No	0.24±0.47	-4.25	0.001
		Yes	65	3.4±2.8						
	6. h cTn	No	135	5.4±6.8	-4.587	0.001				
		Yes	35	9.7±7.4						
	12. h cTn	No	135	13.8±17.9	-4.281	0.001	Yes	0.61±0.68		
		Yes	35	22.4±17.8						

SD: Standard deviation

Table 4. Univariate and multivariate linear regression analyses for predicting the development of Procalcitonin

Procalcitonin											
	Univariate					Multivariate					Correlation	
	RS	F	β	t	p-value	RS	F	β	t	p-value	r	p-value
ACS	0.43	146.95	1.2	15.87	0.001			-0.30	-10.70	0.001	-0.653	0.001
TVD	0.11	25.09	0.23	4.95	0.001			0.06	2.62	0.010	0.335	0.001
Mortality	0.30	86.08	0.55	9.28	0.001			0.78	7.92	0.001	0.550	0.001
IHF	0.04	8.69	0.84	5.03	0.004						-0.205	0.004
cTnI	0.06	11.70	0.28	5.88	5.88						0.236	0.001
cTnII	0.11	23.72	0.19	3.58	0.001	0.63	26.38				0.327	0.001
cTnIII	0.11	25.30	0.18	3.46	0.001						0.337	0.001
Age	0.00	0.2	0.24	0.86	0.388							
Gender	0.00	0.47	0.33	4.88	0.495							
BS	0.00	1.45	0.27	3.12	0.230							

RS: R sequare, ACS: Acute Coronary syndrome, IHF: Ischemic heart failure, cTn: Troponin

Table 5. Univariate and multivariate linear regression analyses for predicting the development of Mortality

Mortality										
	Univariate					Multivariate				
	RS	F	β	t	p-value	RS	F	β	t	p-value
ACS	0.05	11.19	-0.23	-3.34	**0.001**	0.37	11.03	-0.14	-3.53	**0.006**
TVD	0.05	10.37	0.22	3.22	**0.001**			0.11	3.02	**0.037**
Mortality	0.30	86.08	0.55	9.28	**0.001**			0.53	8.31	**0.001**
IHF	0.06	12.23	0.24	3.50	**0.001**			0.21	3.36	**0.001**
cTnI	0.00	0.17	0.03	0.41	0.680					
cTnII	0.01	2.6	0.12	1.66	0.098					
cTnIII	0.01	2.40	0.11	1.55	0.123					
Age	0.00	0.24	0.04	0.49	0.626					
Gender	0.02	4.34	0.15	2.08	**0.39**					
BS	0.01	2.35	0.11	1.53	0.127					

ACS: Acute Coronary syndrome, TVD: Tree-vessel disease, IHF: Ischemic heart failure, cTn: Troponin

Discussion

The data on PCT in ACS are limited and controversial today. The number of the studies on relationships between PCT levels and inferior AMI; anterior AMI, NSTEMI, and UA groups; PCT levels and IHF, TVD and mortality occurring in ACS in ED admissions were less when the literature was reviewed. Therefore, we conducted our study in order to detect these relationships.

Kafkas et al. (16) measured PCT, Il-6, creatine kinase-MB (CKMB), troponin I and C-reactive protein levels in AMI at the time of admission and certain hours and found that PCT level was higher in patients with AMI. Erren et al. (17) indicated that PCT levels were associated with the level of atherosclerosis in cases with CAD and peripheral artery disease. Unlike the other studies, we detected that the PCT level was significantly high in ACS. Atherosclerosis, which is an inflammatory disease, was available based on CAD (18). Biasucci et al. (10) suggested that PCT was released and its level increased in patients with ACS based on the inflammatory processes that occur during AMI in their studies. In similar studies, it was revealed that PCT was an inflammatory marker, and its level increased in patients with AMI (19,20). We detected that PCT increased at a lower level in the UA group, where inflammation was less than the other groups in our study. However, we found that PCT levels were significantly high in STEMI and NSTEMI. These results support the articles stating that PCT may increase based on the inflammatory processes that occur after ACS. The diagnosis of ACS is essential and valuable in determining its prognosis and planning its treatment. It has been found out that the increased PCT levels are associated with a poorer prognosis for CAD, and PCT levels are correlated with the level of atherosclerosis in patients with CAD in recent studies (10,16,21-23). Sinning et al. (24) reported that the PCT levels, which increased at the beginning, are associated with the rate of the cardiovascular case and a higher level of mortality, which increased in the follow-up. Ataoglu et al. (12) measured PCT levels in patients with ACS at the time of application and after 48 hours, and stated that the high level of PCT concentration indicated the increased 6-month-mortality in patients with severe myocardial damage upon infarction in 48 hours after the application. In a study indicating the relationship between troponin and mortality, Antman et al. (25) reported that a high level of cTnI in patients with MI is a good indicator in predicting the possible rate of death.

We detected a significant relationship between PCT level at the time of admission and mortality in our study. We also detected this relationship in cTn levels studied at 6th, and 12th hours. Unlike the literature, we found that PCT and cTnI levels were associated with the increased mortality in ACS.

IHF is one of the most frequent complications of occurring after MI. Rao et al. (26) detected a strong negative correlation between LVEF and cTnT levels in their study on 50 patients with AMI, whose LVEF was under 40%. Accordingly, LVEF may decrease, and cTnT levels may increase at the same rates based on the extent of the infarction site. In a study indicating the relationship between IHF and PCT, Remskar et al. (27) detected that the PCT level increased in complications such as pulmonary edema and cardiogenic shock. We detected IHF, UA, and NSTEMI based on STEMI at a higher level in our study. We found LVEF was at a lower rate in patients with anterior MI among the STEMI subgroups. We detected a significant relationship between heart failure of both the high level of cTnI and PCT values in the evaluation of the relationship between heart failure and both cTnI and PCT.

Particularly the increased level of PCT in heart failure leads to consider that inflammation is an important pathophysiological factor and may affect the prognosis of the patient. In general, the prognosis of CAD is related to the number of affected veins (one-, two-or TVD) and the degree of dysfunction of the left ventricle. A patient with a single affected vein and well left ventricular function have an excellent outcome (5-year survival >90%), whereas a patient with severe left ventricular dysfunction and extensive disease involving three veins has a poor prognosis (28). Since the number of the involved vein has an effect on prognosis, PCT, and cTnI levels of patients who applied due to ACS and in whom TVD was detected after angiography were examined in our study. It was detected that the increase in cTn and PCT levels was higher in patients with TVD and associated with mortality at the same time (21). We consider that PCT is a prognostic factor such as troponin in our study unlike the previous studies according to these data. We also divided ACS into subgroups and examined the relationship between ACS subgroups in our study unlike the other studies. As a result of this, we detected that the PCT level in inferior MI groups was significantly higher than the other subgroups. We detected that TVD and mortality levels in inferior MI groups were significantly high when we examined the relationship between IHF, TVD, and mortality levels of these subgroups. We consider that PCT is a prognostic factor, such as troponin on the contrary to the previous studies in our study, which we conducted based on these data. It should be acknowledged that there are several limitations related to the present study. For instance, this study was conducted in a single center with a small patient group, and the patients were not divided into groups based on their treatment characteristics. A multi-centric study with more patients grouping based on their treatments and with a long-term follow-up can reveal the importance of PCT.

Conclusion

We detected that both cTnI levels and PCT levels increased in CAD in this study. PCT level increased at a lower level than other groups in cases where the level of inflammation such as UA was low, and it also increased at a lower level in NSTEMI than STEMI. This case makes us consider that PCT is correlated with the level of atherosclerosis in patients with CAD, and PCT is released based on the inflammatory processes occurring during MI. We detected that PCT and troponin levels increased in the inferior subgroup among ACS groups in cases such as TVD involvement and mortality affecting the prognosis of the patient. Moreover, IHF was found to be significantly high in the anterior subgroup. We consider that PCT is also a prognostic factor like cTnI. As a result, the increased level of PCT can be a marker that will be used in indicating both ACS and its prognosis.

Ethics

Ethics Committee Approval: The study was approved by the Ethical Committee of Faculty of Medicine of Cumhuriyet University (date: 17/01/2018, decision no: 2018-01726).

Informed Consent: All patients gave written informed consent.

Peer-review: Externally and internally peer-reviewed.

Authorship Contributions

Medical Practices: A.C., C.A., Concept: A.C., Design: A.C., Ş.H.E., Data Collection or Processing: A.C., Analysis or Interpretation: A.C., C.A., Literature Search: A.C., ŞHE., Writing: A.C., C.A.

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A Retrospective Study: When Should We Give Antibiotics to Patients with Febrile Neutropenia in the Emergency Department?

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Abstract

Aim: Febrile neutropenia (FN) is considered to be one of the most important and potentially life-threatening oncologic diseases in the emergency department. Our study aimed to determine whether there is an effective time for decreasing the mortality at the end of the first month after antibiotic administration.

Materials and Methods: This study was designed as a retrospective cohort study. The study population consisted of FN patients who had malignancy >18 years and were admitted to the university hospital between January 2002 and July 2014. A total of 645 patients were included in the study. Of the patients, 322 patients were included in the analysis. The cut-off value for antibiotic administration was determined as ≤6 hours vs >6 hours.

Results: The median age was 54 years, and 173 (53.7%) of the patients were male. Hematological and lung malignancies were found most frequently (46.9%, 12.4%, respectively). The median value of antibiotic administration was 247 minutes, and the mortality rate at the end of the first month was 24.5%. In the logistic regression analysis, the probability of death at the end of the first month in patients who had antibiotic administration >6 hours was found 2.436 times higher than the other group.

Conclusion: As a result, we found that the administration of the first dose of antibiotics to f FN patients in the first 6 hours is effective in reducing mortality.

Keywords: Febrile neutropenia, mortality, time of antibiotic administration

Introduction

Infection is the most important cause of mortality and morbidity in patients with malignancy. The characteristic feature of these patients is the presence of neutropenia, which causes immunosuppression. It is known that severe febrile neutropenia (FN) patients with absolute neutrophil counts <500-1000 cells/mL and fever over 38 °C are associated with an increased risk of severe bacterial infection (1,2).

FN is considered one of the most important and potentially life-threatening oncologic diseases in the emergency department (ED). The deficiency of neutrophils disrupts the inflammatory response, so clinical signs and symptoms may remain confidential in these patients. Therefore, these patients should be treated early, and treatment with broad-spectrum antibiotics should be started. Studies have shown that this reduces the mortality rate (3-5). Cancer patients with FN often refer to ED. These patients may wait a long time for diagnosis and initial treatment, and such delays are associated with increased mortality (6,7).

After fever is detected within one hour, various clinical guidelines recommend starting broad-spectrum antibiotics (3,8). There is no specific guideline recommendation regarding antibiotic administration time (AAT) indicated to reduce mortality in FN patients. If AAT is too long, the length of hospital stay increases in

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adult patients (3,8-11). It seems reasonable to administer the first dose of antibiotics shortly after the first visit to the ED.

This study aimed to determine the relationship between AAT and outcomes in patients with cancer who presented with FN at the ED.

Materials and Methods

Study Design

This was a retrospective cohort study that evaluated clinical manifestations, risk factors, and outcomes in patients with cancer who presented with FN at the ED from January 2002 and July 2014. This study was conducted in a university hospital and was approved by the institutional review board of the hospital. A total of 645 patients were enrolled in this study. Our inclusion criteria for this study were patients with malignancies and aged ≥18 years. Three hundred twenty-two patients were included in the analysis. Patients who were diagnosed with neutropenia and fever without an ED visit and who had missing data, especially for follow-up, were not included in the study (Figure 1).

Treatment Protocol

According to the International FN guidelines, antibiotics were given to the patients (12).

Definitions

Definitions were prepared according to the Infectious Diseases Society of America (3). Oral or axillary temperature equal to 38.3 °C and above for one time or 38.0-38.2 °C for one hour was defined as fever. Neutropenia was defined as a neutrophil level less than 500/mm^3, or a neutrophil level between 500-1000/mm^3 and an expected fall below 500/mm^3 in 48 hours. According to these, the patients were considered as FN patients.

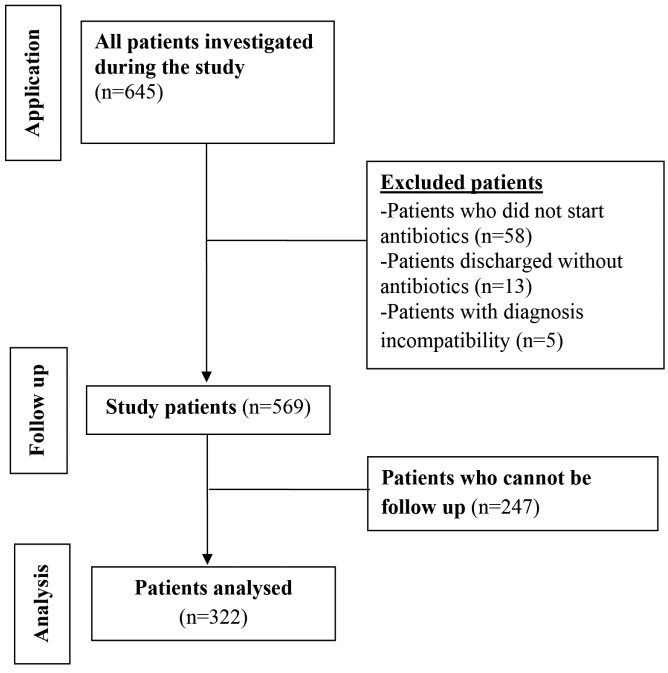

Figure 1. Patient flow chart

The number of neutrophils at the time of the ED visit was categorized into two groups as severe neutropenic (neutrophil level <100/mm^3) and neutropenic (neutrophil level <500/mm^3) groups. Outpatient neutrophil counts were grouped as severe neutropenic (neutrophil level <100/mm^3), neutropenic (neutrophil level <500/mm^3) and normal (neutrophil level 500-1000/mm^3).

AAT was defined as the time from triage to the first dose of parenteral antibiotic administration. Length of stay (LOS) and survival time to hospital discharge were calculated as well. The LOS in the ED was defined as the time from triage to the hospitalization or referral to another hospital.

This study was approved by the Ethics Committee of Akdeniz University. The study was conducted following the ethical principles of Helsinki.

Statistical Analysis

Kolmogorov-Smirnov test was used to assess normality. Normally distributed data were given as mean ± standard deviation. Non-normally distributed data were analyzed using Mann-Whitney U test and were presented as median for the continuous variables and percentage for the categorical variables. Dependent variables were associated with deaths at the end of the first month. Independent variables were age, gender, seasonal period, LOS in the ED, vital signs, use of Granulocyte colony-stimulating factor (G-CSF), pre-admission antibiotic usage, count of applied neutrophils, count of discharged neutrophil, underlying malignancy causes, comorbidities, AAT and the antibiotic protocols, the last chemotherapy and radiotherapy (RT), blood, urine cultures with results. A chi-square test was used to analyze the end of first-month mortality. Logistic regression analysis was performed using independent variables that affect the mortality relationship. Antibiotic timing at each timing cut-off and adjusted odds ratios with 95% confidence intervals for the outcomes were presented. All hypotheses were constructed bidirectional, and the alpha critical value was defined to be 0.05. SPSS 20.0 statistical package program was used for statistical evaluation of our research data.

Results

A total of 322 patients with diagnosed FN were included in the analysis. There were 173 (53.7%) males and 149 (46.3%) females

with a male to female ratio of 1.16:1. The median age was 54 years. Hematological and lung malignancies were the most common malignancies (46.9%, 12.4%, respectively). The basic characteristics of the patients are described in Table 1.

The median LOS in the ED was 3 hours. The duration of admission to ED was ten days for chemotherapy and 39 days for RT. G-CSF was given to 149 (46.3%) patients. Thirty-seven patients (11.4%) have pre-admission antibiotic usage. The causes of infection are shown in Figure 2.

The median value of AAT was 247 minutes, and the mortality rate at the end of the first month was 24.5%. The primary

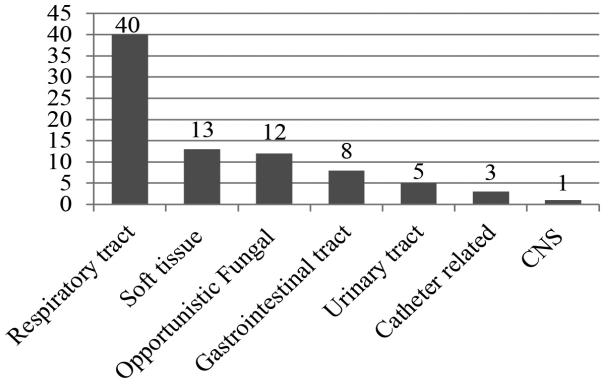

Figure 2. Sources of infection (n)

CNS: Central nervous system

Table 1. Demographic variables of patients

Variable	
Gender	
Male, n (%)	173 (53.7)
Age, median	54
Diagnosis, n (%)	
Hematological malignancies	151 (46.9)
Lung cancer	40 (12.4)
Gastrointestinal tumors	27 (8.4)
Breast cancer	25 (7.8)
Musculoskeletal system tumors	23 (7.1)
Urogenital tumors	18 (5.6)
Head and neck tumors	17 (5.3)
Unknown primary tumors	12 (3.7)
Central Nervous system tumors	9 (2.8)
Comorbidities, n (%)	
Chronic diseases (such as diabetes mellitus, hypertension, asthma)	70 (62.5)
Distant metastasis	38 (33.9)
Neurological disorders (dementia, stroke, epilepsy)	4 (3.6)
Cause of deaths, n (%)	
Febrile neutropenia	80 (59.3)
Dependent on disease	31 (23)
Cardiac	18 (13.3)
Hemorrhage	5 (3.7)

outcomes between the AAT and survival at the end of the first month and LOS were shown in Table 2. No cut-off value has been yet identified for AAT to reduce the mortality associated with FN guidelines when this study was conducted. Quickly administration of the first dose antibiotics in the ED seems to be reasonable. In our study, each antibiotic cut-off time was as categorized ≤1 vs >1 h, ≤2 vs >2 h, ≤3 vs >3 h, ≤4 vs >4 h, ≤5 vs >5 h, ≤6 vs >6 h. Analyses were performed for each cut-off value, and no significant relationship was found between AAT and mortality within the first month except ≤6 vs >6 h. Therefore, timing cut-offs for antibiotics included ≤6 h vs > 6 h. In our study, the mortality rate at the end of the first month was significantly lower (21.8% vs 36.1%, respectively) ($p<0.05$) in FN patients with an AAT of ≤6 h and > 6 h. Then, logistic regression (LR) analysis of mortality-related risk factors was performed to determine the probability of death at the end of the first month. In the LR analysis, the probability of death at the end of the first month was 2.436 times higher in FN patients with an AAT of >6 h compared to other group ($p<0.05$) (Table 3).

Discussion

A prolonged AAT can result in adverse outcomes in immune-compromised patients. In our study, the median value of AAT was 247 min, and the mortality rate at the end of the first month was 24.5%. In similar studies, the median AAT ranged from 19.8 to 300 minutes. In the same cohort studies, mortality rates were found to be 2.8% to 9.4% at the end of the first month (1,13-17). Our hospital is a tertiary center, and patients, especially with end-stage cancer and comorbid conditions, apply to our ED. There was no particular multidisciplinary approach to quickly identify and treat FN patients in the ED. All of these reasons may have resulted in increased mortality and delayed AAT. Quickly administration of the first dose antibiotics in the ED seems to be reasonable.

In our study, the mortality rate at the end of the first month in FN patients who had first AAT within 6 hours was significantly lower (21.8% vs 36.1%, respectively) ($p<0.05$). In the LR analysis, the probability of death at the end of the first month in patients with an AAT of >6 h was found to be 2.436 times higher than the other group ($p<0.05$). In a recent study, two groups were categorized based on the median AAT. The mortality rate within 28 days in the group with longer AAT was found to be 1.18 times higher than the other group. Also, the delay in the administration of antibiotics every hour increases the mortality rate of 18% within 28 days (13). Ko et al. (14) categorized the AAT one to four hours, but no significant relationship was found between AAT and mortality within the first 28 days. As a result of our analysis of risk factors associated with mortality at the end

Table 2. Primary outcomes

	Survival at the end of the first month To Hemorrhage		LOS in hospital (days)					
Cut-offs for AAT (hours)	Alive n (%) 243 (75.5%)	Dead n (%) 79 (24.5%)	Mean rank	Sum of rank	U	Z	#P1 value	µP2 value
≤1 h	1 (100%)	0 (100%)	259.50	259.50				
>1 h	242 (75.4%)	79 (24.6%)	160.69	51421.50	61.500	-1.066	¥1	0.287
≤2 h	10 (58.8 %)	7 (41.2%)	170.09	2891.50				
>2 h	233 (76.4%)	72 (23.6%)	160.49	48789.50	2429.500	-0.416	¥0.143	0.677
≤3 h	60 (69.8%)	26 (30.2%)	164.57	14153				
>3 h	183 (77.5%)	53 (22.5%)	159.69	37528	9798	-0.418	0.151	0.676
≤4 h	119 (75.8%)	38 (24.2%)	158.98	24960	12557	-0.387	0.893	0.702
>4 h	124 (75.2%)	41 (24.8%)	162.93	26721				
≤5 h	167 (78%)	47 (22%)	157.33	33512				
>5 h	76 (70.4%)	32 (29.6%)	168.23	18169	10721	-0.997	0.131	0.319
≤6 h	204 (78.2%)	57 (21.8%)	161.42	41969.50				
>6 h	39 (63.9%)	22 (36.1%)	159.20	9711.50	7820.500	-0.168	0.020	0.866

AAT: Antibiotic administration time, LOS: Length of stay #Chi-square test was used. µMann-Whitney U test was used. ¥Fisher exact test was used.
p1=Comparison between AAT and survival at the end of the first month, p2=Comparison between AAT and LOS

Table 3. Logistic regression analysis of factors related to mortality at the end of the first month

Variables related to mortality at the end of the first month	B	SE	OR	(95% CI)	p
Regression coefficient	-2.791	0.380	0.061		0.000
†DBP hypotensive patients	1.03	0.344	2.726	(1.390-5.347)	0.004
†Hypoxic patients	1.096	0.389	2.993	(1.395-6.421)	0.005
†CDN severe neutropenic patients[c]	2.941	0.470	18.976	(7.538-47.565)	<0.001
†CDN neutropenic patients[c]	1.711	0.431	5.536	(2.377-12.897)	<0.001
†Positive blood culture[d]	0.963	0.488	2.619	(1.007-6.815)	0.048
†Patients had no blood culture[d]	1.291	0.412	3.637	(1.623-8.150)	0.002
†Patients with hematological malignancy [e]	-1.711	0.406	0.181	(0.082-0.401)	0.061
†AAT>6 h[f]	0.890	0.414	2.436	(1.081-5.489)	0.032

B: Regression coefficient, SE: Standard error, DBP: diastolic blood pressure, CDN: Count of discharged neutrophil, AAT: Antibiotic administration time, †Reference categories, a: DBP normal and hypertensive, b: Pulse O_2 normal, c: CDN normal, d: Negative blood culture, e: Solid tumors, f: AAT≤6 h

of the first month, FN patients who were hypoxic, hypotensive, tachycardic, and tachypnoeic had higher mortality ($p<0.05$). This situation can be explained by the fact that patients had sepsis or septic shock during admission to the ED. Severe neutropenic or neutropenic patients had higher mortality at the end of the first month compared to the other groups ($p<0.05$). Patients with hematologic malignancy had 0.181 times higher mortality at the end of the first month ($p<0.05$). Patients with hematological malignancy receiving chemotherapy are known to have more FN. Perrone et al. (11) found that the admission of patients with underlying hematological malignancies' to an intensive care unit or their mortality risk was 5.5 times higher. Similarly, Rosa and Goldani (13) stated that patients with hematological malignancies had 1.20 times higher mortality than those with solid tumors.

In our study, the median LOS in the ED was 3 hours. We found that there was no statistically significant relationship. Studies showed that there was no significant relationship between delayed treatment and LOS (1,14).

Study Limitations

There are several limitations to this study. Due to retrospective design, we might have data losses. Data sources of our study were file records, death notification system, and hospital information system; so, there might be missing data in the records in the system. From 2002 to 2014, with social, economic, and environmental changes, the development of technology and the health care system might have affected the relationship between cause and effect. Further studies are needed with larger patient populations with multiple centers.

Conclusion

As a result, we found that the administration of the first dose of antibiotics to febrile neutropenic patients in the first six hours is effective in reducing mortality.

Ethics

Ethics Committee Approval: Retrospective study.

Informed Consent: Retrospective study.

Peer-review: Externally and internally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: M.K., S.S., A.A., F.B., Concept: M.K., S.S., A.A., F.B., Design: M.K., S.S., Data Collection or Processing: M.K., S.S., A.A., F.B., Analysis or Interpretation: M.K., S.S., Literature Search: M.K., S.S., A.A., F.B., Writing: M.K., S.S.

Conflict of Interest: No conflict of interest was declared by the authors.

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Assessment of Emergency Service Attendance Due to Rabies Suspect Animal Bites in the Van Region

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Abstract

Aim: Rabies is a zoonotic viral disease transmitted by the bite of an animal. In Turkey, 100,000 individuals are administered prophylaxis annually after contact with animals carrying the risk of rabies. In this study, we investigated compliance with treatment and the affecting factors.

Materials and Methods: The study assessed data from a total of 813 patients with potential animal bites throughout the year 2013.

Results: The mean age of participants in the study was 22.6±16.8 years, and 80.6% (n=655) were male. Participants of both sexes mainly attended in the spring and summer months; however, it was identified that the rate of women attending in winter was higher than men. Also, five doses of vaccination were ordered for nearly all patients, independent of immunoglobulin administration; however, the rate of patients completing all five doses remained at about 30%.

Conclusion: Increasing awareness of rabies will aid in the control of the significant public health problem of potential bite cases. As the young population is at risk, it is necessary to take precautions for the childhood age group.

Keywords: Emergency service, rabies, animal bites

Introduction

Rabies disease is a zoonotic viral disease transmitted by bites from an animal with rabies. The rabies virus is a bullet-shaped, single-chain, negative-strand RNA virus from the Rhabdoviridae family. Clinical symptoms progress with acute encephalitis, causing mortality in humans and animals (1,2). According to the 2010 World Health Organization (WHO) data, it is reported in more than 150 countries. The most important source of transmission to humans is the animals living in close surroundings. Some carnivores and bats are natural reservoirs, but 99% of transmission to humans occurs via dogs (3,4).

Deaths linked to rabies in many countries are not reported, especially in the young age group (4). Additionally, a significant portion of the 55,000 annual deaths occurs in Africa and Asia. It is observed in every age group, but children under the age of 15 years are the at-risk group. Of vaccinations linked to potential bites from rabid animals, 40% are administered to the 5-14-year age group. It is known that the male gender is dominant in the vaccinated population (5). Beginning with fever and frequently pain and paresthesia around the wound, rabies disease develops with encephalitis progressing to mortality after the virus spread through the central nervous system. Within a few days, death is observed after cardiovascular arrest (4,6,7). Rabies disease with paralytic progression is less dramatic and lasts longer, but

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mostly results in death. Paralytic rabies disease is frequently not reported due to a lack of diagnosis (4).

As there is no effective treatment for rabies, prophylaxis after contact is very important (8). Prophylaxis with vaccinations prepared in modern tissue and rabies immunoglobulin (RIG) after contact with rabies ensures close to 100% success with accurate dose administration at the right time. WHO has a broad spectrum concerning prophylaxis after contact, including the Essen regimen. The Essen regime recommends intramuscular administration of 5 doses of human diploid cell rabies vaccine (on days 0, 3, 7, 14, 28) in addition to RIG. The Center for Disease Control (CDC) in 2009 did not include the dose on the 28th day in the regime and modified it to four doses and RIG. There are studies showing compliance to four-dose treatment is better than compliance with five-dose treatment (9-11). In the literature, after the first administration, compliance appears to reduce linked to factors such as forgetting, missing or neglecting, patient's health status, age, and gender (12-15).

Vaccinations produced from cell cultures and produced from embryo egg cell cultures are used around the world. Apart from the vaccine, there are two types of RIG used for rabies prophylaxis; the human RIG (HRIG) with a recommended dose of 20 IU/kg and the RIG (ERIG) used at 40 IU/kg dose. According to the recent recommendations of WHO and CDC, if the wound is anatomically suitable, the full dose RIG should be administered around the wound (16).

Together with a reducing trend in human cases through the years, animal cases continue to represent a significant problem. In Turkey, 100,000 people are administered prophylaxis annually after contact with animals at risk of rabies (17). Rabies prophylaxis is completed following the Rabies Protection and Control Regulation by the Ministry of Health General Directorate of Primary Health Care. Rabies vaccines and RIG are acquired under state authority.

Monthly mean 70-80 and annually 800-900 cases attend our clinic with potential animal bites. 98% of them received immediate prophylaxis. Due to the high mortality of rabies disease, the number of individuals receiving prophylaxis may be higher than necessary. As a result, this is significant for the efficacy of the vaccine and side effects. Currently, the side effects linked to the vaccine are less severe and very rare, varying according to the origin of the vaccine (18-22).

The necessity for regular administration of the prophylaxis regime and the side effects of the vaccine affect individual compliance. In this study, the compliance and factors affecting the compliance of patients receiving prophylaxis after attending our clinic with a preliminary diagnosis of potential rabid animal bites were investigated.

Materials and Methods

The study was completed with information obtained from patients attending the emergency service of an education and research hospital in the Van region from 01.01.2013 to 31.12.2013. The study assessed data from a total of 813 patients. The type of contact (bite, scratch, splash in the mucous membranes, etc.) and the condition of the animal (breed, vaccination status, etc.) are taken into consideration.

Statistical Analysis

Statistical analyses used the SPSS version 15 software. Statistical significance was accepted as $p<0.05$. Descriptive statistics such as age were given as mean ± standard deviation. Categorical variables, such as gender, planned dose of vaccine, the dose of vaccine administered, immunoglobulin administration, etc. were given as numbers and percentages.

Results

Our study assessed the data from a total of 813 patients, 80.6% male (n=655) and 19.4% female (n=158). The demographic data and treatment characteristics of participants in the study are summarized in Table 1.

The differences between the sexes in terms of demographic characteristics and clinical parameters are summarized in Table 2. Accordingly, participants of both sexes mainly attended in spring and summer; however, it is notable that the proportion of females attending in winter was elevated compared to males. There was no statistically significant difference observed among participants in terms of residential areas and planned and administered vaccine doses.

The distribution of planned and administered vaccine doses according to immunoglobulin administration is shown in Table 3 for study participants. As suggested by the Essen regime, five doses of vaccination were planned for nearly all of the patients, independent of immunoglobulin administration; however, only 30% of patients completed all five doses.

Discussion

Rabies is one of the zoonotic diseases progressing with mortality that threatens the whole world (23,24). Rabies is a serious health problem, especially in developing countries like Turkey. Despite reductions in frequency due to the Ministry of Health vaccination and prophylaxis protocols, it is still an important disease vector in regions with low socioeconomic status and in provinces with

Table 1. Demographic and clinical characteristics of the study group

		Mean	SD
Age mean ± SD		**n (22.6)**	**(16.8)%**
Sex	**Male**	655	80.6
	Female	158	19.4
Residence	**Center**	455	56.5
	Periphery	350	43.5
Month of attendance	**January**	70	8.6
	February	65	8.0
	March	58	7.1
	April	53	6.5
	May	83	10.2
	June	96	11.8
	July	103	12.7
	August	84	10.3
	September	71	8.7
	October	53	6.5
	November	34	4.2
	December	43	5.3
Immunoglobulin administration	**Yes**	495	61.2
	No	314	38.8
Planned vaccination dose	**1 dose**	1	0.1
	2 dose	1	0.1
	4 dose	6	0.7
	5 dose	804	99.0
Dose administered	**1 dose**	76	9.4
	2 doses	87	10.7
	3 doses	204	25.2
	4 doses	173	21.3
	5 doses	271	33.4

SD: Standard deviation

Table 2. Distribution of demographic and clinical characteristics of the study group according to sex

Mean (SD)		Male	Female	p
		Mean (SD)		
AGE mean ± SD		21.7 (15.7)	26.1 (20.5)	0.232
Residence	**Center**	363 (56.1)	92 (58.2)	0.629
	Periphery	284 (43.9)	66 (41.8)	
Month of attendance	**January**	62 (9.5)	8 (5.1)	**0.02**
	February	44 (6.7)	21 (13.3)	
	March	50 (7.6)	8 (5.1)	
	April	41 (6.3)	12 (7.6)	
	May	59 (9.0)	24 (15.2)	
	June	74 (11.3)	22 (13.9)	
	July	83 (12.7)	20 (12.7)	
	August	70 (10.7)	14 (8.9)	
	September	59 (9.0)	12 (7.6)	
	October	49 (7.5)	4 (2.5)	
	November	28 (4.3)	6 (3.8)	
	December	36 (5.5)	7 (4.4)	
Immunoglobulin administration	**Yes**	401 (61.6)	94 (59.5)	0.626
	No	250 (38.4)	64(40.5)	
Planned vaccination dose	**1 dose**	-	1 (0.6)	-
	2 dose	-	1 (0.6)	
	4 dose	3 (0.5)	3 (1.9)	
	5 dose	651 (99.5)	153 (96.8)	
Dose administered	**1 dose**	64 (9.8)	12 (7.6)	0.246
	2 doses	76 (11.6)	11 (7.0)	
	3 doses	157 (24.0)	47 (29.9)	
	4 doses	142 (21.7)	31 (19.7)	
	5 doses	215 (32.9)	56 (35.7)	

SD: Standard deviation

Table 3. Distribution of vaccination administration according to immunoglobulin administration

n		Immunoglobulin (+)		Immunoglobulin (-)	
		%	n	%	
Planned vaccination dose	**1 dose**	1	0.2	-	-
	2 dose	-	-	1	0.3
	4 dose	1	0.2	5	1.6
	5 dose	493	99.6	307	98.1
Dose administered	**1 dose**	45	9.1	31	9.9
	2 doses	46	9.3	41	13.1
	3 doses	125	25.3	79	25.3
	4 doses	111	22.4	62	19.9
	5 doses	168	33.9	99	31.7

intense animal husbandry. Due to the disease being a significant public health problem, primary protection is essential. Animals suspected of having rabies should be removed from the environment, and individuals living in risky regions should be informed about this topic. Primary protection is not always sufficient for rabies disease. Vaccination after contact is crucial.

In our study assessing the rabies prophylaxis regime and treatment compliance of patients attending our clinic with suspect animal bites and rabies suspicion, data from 813 patients were investigated. The mean age of patients beginning treatment was 22.6±16.8 years. Of the cases in our study, 39.1% were aged 11 years or younger, and 54.4% were aged 18 years and older. Another study investigating patients attending the emergency service found that 54% of patients were aged 18 or younger (25).

As seen in studies, the young age group is at risk of this disease, but there was no correlation identified with age. Additionally, attendance in the first 24-48 hours after contact with the disease is considered to be effective in reducing mortality that may occur due to rabies.

Most of the patients attending with suspect animal bites were male. Males are involved more in agriculture and animal husbandry and spend a long time outside compared to females, which may have increased their chances of encountering danger. In the literature, it is reported that rural contact is less compared to urban contact. More than half of our cases (56.1%) attended from the city center. The study by Temiz and Akkoç (26) identified lower attendance from rural areas. Again, a study by Tunç et al. (25) found that attendance from urban areas was more common. One reason for frequent attendance from the city center may be that access is easier. Also, it may be due to the control of stray animals being harder in urban areas.

Again, another reason may be that awareness about attending a vaccination center for rabies is not at sufficient levels among those living in rural areas (27).

Generally, rabies cases intensify in spring and summer. This period is known as the aggressive period for dogs. Due to wearing thinner clothes and spending more time outdoor, animal bites increase in summer. The study identified that the potential animal bite cases increased in spring and summer when individuals spend more time outside. Nearly half of the cases (50.7%) were in the period from April to August. In the literature, there is not much information about seasonal variations in rabies disease. Also, females had higher potential rabid animal bites in winter compared to males (p=0.02); however, this is not an expected result. Studies to be performed must consider the periodic effects on disease control.

In developing countries, rabies is transmitted to humans by bites from stray animals, especially dogs. In cases, attention is paid to dogs, especially, but also cats and other domestic animals, bats, and other wild animals (28). In our study, the distribution of potential rabies bites was not investigated, but it is considered that the incidence of dog bites was high. For transmission of rabies, direct contact with infected saliva in some situations involving biting, scratching, and licking is the most important route. Most of the cases identified in the study had a history of bites. An assessment by Yılmaz et al. (29) observed that more than half of the cases (56.1%) had a history of bites. Most of the cases, having a history of bites and being from the city center lead to consideration that local administrations do not have sufficient success in controlling rabies. Again, the insufficient number of stray animal shelters in Van city center may be an important cause.

The contact region of potential rabies bite varies according to the age and physical features of the person. The most common injured region in the literature appears to be the extremities. This information was not collected in the study; however, it was observed that the extremities were most commonly injured clinically, especially at a young age (29,30).

Globally, it is known that between ten and twelve million cases have prophylaxis after rabies contact. In Turkey, there is a reduction observed in human rabies cases, but the suspect bite cases have not reduced. Annually, our country administers prophylaxis to 100,000 bite cases. The rabies risk contact incidence was 211.35 per hundred thousand in 2005 (27). In the early period, local wound care and washing the wound with water and soap are the most effective treatment methods (31). In our clinic, immunization was planned after washing the patients' wounds. Doses were planned as follows; 0.1% 1 dose, 0.1% 2 doses, 0.7% 4 doses and 99.0% 5 doses. The incidence of 5 dose vaccination plans was 99.5% for male patients and 96.8% for female patients. In cases where animal monitoring could be performed, three-dose vaccination is sufficient, while five doses were planned for cases without animal monitoring. Vaccine, along with rabies HRIG administration, is life-saving (32). Of cases, 61.2% had HRIG administered. Rabies studies have observed that RIG administration is not at desired levels (27,29). Cases in Turkey were identified to have higher levels of immunoglobulin administered; however, it was not observed to be at sufficient levels.

There was no information collected related to whether animals had owners in the cases, which led to all cases requiring vaccination. Prophylaxis vaccination is mandatory due to not knowing whether animals are vaccinated or not. This is a public health problem and is encountered with a different dimension in the country's economy. Of cases, 99.0% had five-dose vaccination planned; however, 33.4% fully completed the five doses. The planned (96.8%) and administered (35.7%) incidence was higher among females, while fewer were administered (32.9%) for males (p=0.246). In developed countries, vaccination planning is done according to case circumstances. A study in the United States of America concluded that vaccination was required for only 6.7% of cases (33). Surveillance and monitoring are found to be primary paths for the management of potential rabies bite cases. In the study, 99.6% of cases with immunoglobulin administered, had five dose vaccination planned, while 33.9% were vaccinated with five doses. The reason for the difference between planned and administered vaccination doses may be linked to factors such as the administration method of the vaccine, side effects linked to the vaccine, forgetting administration, missing or not attending appointments, patient health status, age, and gender (12-15).

There were no side effects linked to the vaccine observed in our study. Again, in the study period, there were no deaths linked to potential rabid animal bites.

Conclusion

One of the most effective solutions for reducing the risk of rabies contact is taking control of stray animals in animal shelters. In these places, street cats and dogs are collected, cared for, and vaccinated, which may ensure primary protection by performing animal fostering and neutering studies. Increasing awareness of this type of application and service, which is among municipality responsibilities, will aid in the control of the significant public health problem of potential rabies bite cases. As the young population is at most risk, the necessity to take precautions among the childhood age group was noted.

Ethics

Ethics Committee Approval: Çanakkale Onsekiz Mart University Clinical Research Ethics Committee (approval number: 02.01.2019/01-02)

Informed Consent: Consent form was filled out by all participants.

Peer-review: Externally and internally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: B.V., Concept: B.V., H.Ç., M.B., Design: S.Y., M.B., Data Collection or Processing: B.V., Ö.O., Analysis or Interpretation: S.Y., H.Ç., Literature Search: B.V., H.Ç., M.B., Ö.O., Writing: B.V., M.B.

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Knowledge Levels and Attitudes of Emergency Physicians in the province of Ordu about Child Abuse: A Survey Study

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Abstract

Aim: The number of studies conducted to find out the knowledge level of emergency physicians in Turkey about child abuse and neglect are limited. In this study, knowledge levels and attitudes of emergency physicians on the issue were assessed within the scope of literature.

Materials and Methods: Male and female physicians who worked in the emergency services of state hospitals in Ordu province provincial directorate of health between the dates 01.06.2018 and 01.09.2018 and who volunteered to participate were included in the study. The participants were given a 28-item questionnaire form which assessed the participants' demographic characteristics and their attitudes towards child abuse and "Child Abuse Knowledge scale".

Results: 73.2% of the physicians who participated in the study were general practitioners, while 26.8% were emergency medicine specialists. The rate of physicians who came across child abuse cases in the emergency service was found as 57.5%. 86.6% of the physicians stated that child abuse cases required a multidisciplinary approach.

Conclusion: 88% of the physicians stated that they did not have any post graduate training on child abuse and most of the physicians stated that their post graduate training was not sufficient. Increasing training about the issue before or after graduation can improve physicians' attitudes and behaviours towards child abuse cases. It will be easier to resolve the incident with a multidisciplinary approach when necessary if physicians make an assessment of child abuse as part of examination in each child they examine.

Keywords: Child abuse, child's best interest, emergency service, physician

Introduction

Child abuse, which is defined by World Health Organization (WHO) as behaviors which are conducted knowingly or unknowingly by an adult, the society or the country, and which negatively affects a child's health, physical and social development, is in its widest sense conducting behaviors which are not accepted in that society to a child by an adult within a specific period of time (1). Child abuse is an important problem that is seen in all parts of the world. Although the type of abuse differs depending on factors such as gender, geographical region, and other factors, it is seen within a wide range of 1-35% (1,2). While the incidence of child abuse is 10-53% in Turkey, this rate is around 1-10% globally (3).

Neglect and abuse are familial function disorders that have multiple psychosocial, individual, and environmental reasons. They are difficult to define, and they require health professionals to be suspicious when they meet the family and the child for the first time (1). Some factors about the health system prevent the patient and the physician from being together within a necessary and extended period of examination, and this makes early diagnosis difficult. This situation can lead to the continuation of neglect/abuse. This way, undiagnosed neglect/abuse causes chronic abuse and increased death and disease rates (1,4). WHO emphasizes that it is among the responsibilities of health professionals to provide a proper diagnosis, protection, and treatment conditions to neglected and abused children (5). It is

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emphasized as an issue in literature for health workers to be aware of the physical and behavioral characteristics of child abuse and to have sufficient proficiency in treating, preventing, and reporting child abuse (6).

In this study, knowledge levels and attitudes of emergency physicians on the issue of child abuse and neglect were assessed within the scope of literature.

Materials and Methods

Study Design, Population and Data Collection

Approval was obtained from Ordu University Clinical Researches Ethical Board (decision number: 2018/155) for the study. Male and female physicians who worked in the emergency services of state hospitals in Ordu province provincial directorate of health between the dates 01.06.2018 and 01.09.2018 and who volunteered to participate were included in the study. A total of 10 physicians who did not want to participate in the study and those who filled in the question forms incompletely were excluded.

In addition to a 28-item questionnaire form that assessed participants' demographic characteristics and their attitudes towards children, the "Child Abuse Knowledge scale" with 25 items, which was developed and examined for validity and reliability by Kara et al. (7), was given to the participants. In the knowledge scale, each question included three answers consisting of the words "yes", "no", and "no idea"; the answers to questions 14, 16, 21, and 23 were "no", while the others were "yes". Each correct answer was accepted as "1 point" and knowledge scores were calculated separately for five sections as "history", "examination", "radiology", "risk groups" and "symptoms". Also, scores of the sections were added, and a total knowledge score was obtained on the issue of child abuse and neglect (7). After the informed consent of the physicians within the sample group was obtained, the questionnaire and the scale were filled in by the physicians who participated in the study. The number of participants in the study was determined to be 125 according to Tavsancil's "sample volume in the scale studies should be at least five times the minimum of each scale item" recommendation (8).

Statistical Analysis

A statistical package program was used for statistical analysis. Descriptive analysis of assessment results was given as numbers and percentages for categorical variables and as mean, standard deviation, minimum, and maximum for numerical variables. A chi-square test was used for the analysis of categorical variables. Shapiro Wilk test was used to determine the appropriateness of scale scores to a normal distribution. The Mann-Whitney U test was used for non-normally distributed variables between two groups and the Kruskal-Wallis test for non-normally distributed parameters between more than two groups. $p<0.05$ was considered as statistically significant.

Results

A total of 127 physicians, 66 (52.0%) female and 61 (48.0%) male, participated in the study. The mean age of the physicians was 29.44±5.42 years (range: 23-54). Forty point two percent of the physicians were married, while 76% were single, and 28.3% had children. Seventy-three point two percent of the physicians who participated in the study were general practitioners, while 26.8% were emergency medicine specialists. In terms of years in the profession, the minimum period in the profession was one year, while the maximum period was 29 years, with an average of 4.98±4.49 years. The mean time spent in the emergency service was found as 3.76±3.74 years.

While no statistically significant difference was found between general practitioners and specialists in terms of having received forensic medicine education before graduation, the rate of having received training about child abuse was found to be statistically significantly higher in general practitioners when compared with specialists ($p<0.001$). While physician groups were not homogeneous in terms of pre-graduation training, they formed a homogeneous group in terms of post-graduation training (Table 1).

The rate of physicians who came across child abuse cases was found to be 57.5%. Eight of these physicians stated that they performed a genital examination for sexual abuse cases in the emergency service, and they also stated that they did not experience any problems with the examination. Thirteen point four percent of the physicians stated that the children who referred to emergency service for being poisoned could not be assessed as "child abuse". Eighty-six point six percent of the physicians stated that child abuse cases required a multidisciplinary approach, and 80.8% thought that child abuse should not be considered as unidimensional and that reports should not be prepared without making the required consultations for the child's examination (pediatric psychiatry, general surgery, pediatric diseases, gynecology, infectious diseases, and forensic science). While 55.9% of the physicians stated that it would be suitable for child monitoring centres (CMC) to assess all kinds of abuse cases so that child abuse cases could be appropriately assessed, 3.1% stated that it would be enough for only sexual abuse cases to be assessed at CMC, and other cases could be resolved at emergency services and polyclinics. It was found to be statistically significant that emergency physicians frequently came across child abuse cases ($p<0.001$). In terms of the

question of which abuse cases referred to the emergency service the most, both groups answered this question as "neglect" the most and statistically significant difference was found between the two groups (p=0.005). Also, general practitioners answered the question of which abuse group was missed the most in the emergency service due to difficulties of diagnosis as "emotional abuse," and statistically significant difference was found between the answers of both groups (p=0.027) (Table 2). Fifty-nine point

Table 1. Physicians' educational status before and after graduation

Physicians' educational status	Specialist (n)	General practitioner (n)	p
Pre-graduation training (forensic medicine)			
Not educated	-	5	0.168
Educated	34	88	
Pre-graduation training (child abuse)			
Not educated	17	10	<0.001
Educated	17	83	
Pre-graduation training evaluation			
Enough	-	25	<0.001
Partially enough	15	54	
Not enough	19	14	
Post-graduation training (child abuse)			
Not educated	30	82	0.992
Educated	4	11	
Post-graduation training evaluation			
Enough	-	9	0.124
Partially enough	10	31	
Not enough	24	53	

Table 2. Physicians' views and assessments about abuse cases in the emergency service

Physicians' views and assessments	Specialist (n)	General practitioner (n)	p
Encountering with the child abuse cases			
Encountered	31	42	<0.001
Not encountered	3	51	
The most common type of child abuse cases in the emergency department			
Sexual abuse	-	4	0.005
Emotional abuse	2	11	
Physical abuse	4	34	
Neglect	28	44	
The most common skipped type of child abuse cases in the emergency department			
Sexual abuse	17	25	0.027
Emotional abuse	11	55	
Physical abuse	3	3	
Neglect	3	10	
Are poisoned children a case of abuse?			
Yes	34	76	0.07
No	-	17	
Using the form of child abuse			
Used	10	25	0.77
Not used	24	68	

eight percent of the physicians stated that when symptoms of child abuse were found in a child who was brought to the emergency service for another reason, they would accept the case as a judicial case, write a judicial report and inform the judicial authorities. Thirty-five point five percent of the participants stated that it would be suitable to get a consultation from physicians such as forensic medicine and pediatric surgery physicians and/or be supported by organizations such as CMC, etc. and to make a decision afterward. All of the physicians stated that they prepared judicial reports when such cases were defined. Fifteen point seven percent of the physicians stated that there were no criminal sanctions when no reports were made, while others reported that there were criminal sanctions, and 41.7% stated that this sanction was one year of imprisonment. In terms of the existing legal sanctions in Turkish Penal Code (TPC) about sexual abuse crime conducted against children, 55.1% of the physicians described these sanctions as mild, while 20.5% described them as very mild, 15.7% as sufficient, 3.9% as severe and 4.7% as very severe.

It was found that the physicians who participated in the study got a minimum of 11 points from the Child Neglect and Abuse Information scale, while they got a maximum of 25 points. The standard mean of the total scale scores was 20.98±2.96, and Table 3 presents the results of physicians' total score averages in terms of some of the characteristics of physicians. In the post hoc test (with Bonferroni), it was seen that total test mean scores were according to the statistically significant low between 34-38 age group of physicians and 23-28 ($p=0.01$) and 29-33 age groups of physicians ($p=0.03$). Also, the total test score of the physicians who received pre-graduation child abuse education and found this education to be adequate was found to be statistically higher than the physicians who found it to be inadequate ($p=0.05$).

Average scores of the subdivisions of Child Neglect and Abuse Information scale were 5.83±0.46 for part 1, 5.48±0.76 for part 2, 2.07±0.79 for part 3, 4.37±1.37 for part 4 and 3.22±0.92 for part 5. The distribution of divisional and total points "Child Neglect and Abuse Knowledge scale" received by physicians was showed in Table 4.

Discussion

In our country where anyone who is younger than 18 years of age is considered as children, child abuse is a significant public health issue with medical, legal, and social aspects, which can cause serious injuries, disabilities, and even death (9-11). Recently, our country lets in too many immigrants, and in complex situations that can develop with the problems of immigrant children, the solution is expected from physicians. Various studies conducted show that the rates of child abuse among judicial cases that refer to emergency services differ between 18-43% (12-14). In the case of a correct assessment of the symptoms by the physician, the diagnosis of child abuse is considered to be the first step in the solution of the problem.

In a study conducted in the province of Ankara, it was found that 82% of pediatricians, 70.5% of pediatrician assistants, and 54.8% of general practitioners came across abuse and neglect cases or suspicion (9). In a thesis study, it was found that the rate of coming across child abuse and neglect cases in the past year was 21.1% and that all participants, in general, had a lack of knowledge and experience about child abuse and neglect (15). Similar to other studies, the rate of child abuse in emergency services was found as 53%. In another study conducted in Kuwait, it was found that 14% of pediatricians did not come across a suspicious child abuse case all through their lives (16). In another study conducted in Sweden, very low rates of cases were found in primary health care providers, and it was even emphasized that a physician who worked more than 30 years did not come across any cases (17). In our study, all of the physicians stated that they reported when cases were diagnosed. Also, while 86.6% of the physicians in the study group were advocates of a multidisciplinary approach, only 34.6% stated that they would report after they got the views of related units and polyclinics about child abuse and 55.9% stated that they would report immediately when they found symptoms of abuse. In another study conducted in our country, 85% of the physicians stated that they would think about reporting if they came across abuse cases or suspicion (9). In the same study, the reasons why physicians did not report were respectively as follows; not having enough information about child abuse and neglect, not knowing where they should report, not having time to allocate to this issue, security concerns, thinking that the child will get harm later, thinking that the child will be separated from the family and other reasons (9). In a national study conducted in America, it was found that only a small number of pediatricians did not report in cases that had injuries suspicious in terms of child abuse (18-20). The reason why physicians did not report was the fact that a definitive diagnosis was not made for abuse and that they believed the problem could be solved within the family (20). In another study conducted in North Carolina, it was stated that 10% of the participants did not report suspected child abuse and neglect cases, and the reason for this was the fact that they thought the court was a painful and sad experience for children (21). While physical abuse is a situation which is frequently realized since relatively a higher number of symptoms are together when compared with other types of abuse, it is known that the rates of recognizing physical abuse are lower as long as physical abuse and sexual abuse are a combined component. In our study, physicians stated that the most frequent number of cases (56.6%) that referred to the emergency service was neglect cases, with physical abuse (29.9%) as the second most frequent number of cases.

Table 3. Mean child neglect and abuse knowledge scale scores of the physicians in the study in terms of their specialties

Characteristics	n	Mean ± SD	p
Sex*			
Female	66	21.53±2.85	0.018
Male	61	20.39±2.99	
Age*			
23-28 ages	72	21.51±2.36	0.017
29-33 ages	33	21.27±2.57	
34-38 ages	10	18.00±3.33	
31 ages and older	12	19.50±2.96	
Title			
General practitioner	93	21.78±2.80	0.442
Specialist	34	20.52±3.36	
Marital status			
Married	51	20.37±3.41	0.139
Single	76	21.39±2.56	
Child status			
Having children	36	20.52±3.63	0.712
No children	91	21.16±2.65	
Working time in ED			
One year and below	65	21.26±2.75	0.386
Two years and over	62	20.69±3.17	
Pre-graduation training			
Educated	100	21.26±2.49	0.362
Not educated	27	19.96±4.20	
Post-graduation training			
Educated	15	21.93±2.34	0.158
Not educated	112	20.85±3.02	
The situation of encountering cases of child abuse			
Encountered	73	20.86±2.97	0.482
Not encountered	54	21.14±2.97	
Pre-graduation training evaluation*			
Enough	25	22.24±2.89	
Partially enough	69	20.88±2.24	0.010
Not enough	33	20.24±3.98	
The most common type of child abuse cases in the ED			
Sexual abuse	4	21.25±2.06	0.998
Emotional abuse	13	20.84±2.99	
Physical abuse	38	21.02±2.92	
Neglect	72	20.97±3.07	
The most common skipped type of child abuse cases in the ED			
Sexual abuse	42	21.83±2.12	0.151
Emotional abuse	66	20.68±3.30	
Physical abuse	6	19.33±3.14	
Neglect	13	20.53±3.04	

ED: Emergency department, SD: Standard deviation, *p<0.05

Table 4. Distribution of divisional and total points "Child Neglect and Abuse Knowledge scale" received by physicians

Characteristics	Part 1 story Mean ± SD (min-max)	Part 2 examination Mean ± SD (min-max)	Part 3 radiological evaluation Mean ± SD (min-max)	Part 4 risk groups Mean ± SD (min-max)	Part 5 symptoms Mean ± SD (min-max)	Total Mean ± SD (min-max)
Sex*						
Female (n=66)	5.87±0.32 (5-6)	5.50±0.80 (3-6)	2.21±0.79 (1-3)	4.54±1.36 (0-6)	3.39±0.83 (1-4)	21.53±2.85 (11-25)
Male (n=61)	5.78±0.58 (3-6)	5.45±0.72 (4-6)	1.91±0.78 (0-3)	4.19±1.37 (0-6)	3.03±0.98 (1-4)	20.39±2.99 (11-25)
Age*						
23-28 ages (n=72)	5.88±0.31 (5-6)	5.47±0.73 (4-6)	2.01±0.79 (0-3)	4.77±0.98 (2-6)	3.36±0.87 (1-4)	21.51±2.36 (16-25)
29-33 ages (n=33)	5.78±0.54 (4-6)	5.69±0.58 (4-6)	2.36±0.69 (1-3)	4.33±1.29 (1-6)	3.09±0.94 (1-4)	21.27±2.57 (14-25)
34-38 ages (n=10)	5.50±0.97 (3-6)	5.00±0.81 (4-6)	1.40±0.51 (1-2)	2.90±1.44 (0-5)	3.20±0.78 (2-4)	18.00±3.33 (11-23)
39 ages and older (n=12)	5.91±0.28 (5-6)	5.38±0.85 (3-6)	2.16±0.93 (1-3)	3.33±2.14 (0-6)	2.75±1.13 (1-4)	19.50±4.88 (11-23)
Title						
General practitioner (n=93)	5.91±0.50 (3-6)	5.48±0.71 (4-6)	2.37±0.79 (0-3)	4.65±1.24 (0-6)	3.37±0.92 (1-4)	21.68±2.80 (11-25)
Specialist (n=34)	5.88±0.32 (5-6)	5.47±0.89 (3-6)	2.32±0.76 (1-3)	3.79±1.55 (0-6)	3.05±0.91 (1-4)	20.52±3.36 (11-24)
Marital status						
Married (n=51)	5.86±0.44 (4-6)	5.41±0.82 (3-6)	2.07±0.84 (1-3)	4.00±1.54 (0-6)	3.01±0.98 (1-4)	20.37±3.41 (11-25)
Single (n=76)	5.81±0.48 (3-6)	5.52±0.72 (4-6)	2.06±0.77 (0-3)	4.63±1.18 (0-6)	3.35±0.85 (1-4)	21.39±2.56 (11-25)
Child status						
Having children (n=36)	5.91±0.28 (5-6)	5.41±0.87 (3-6)	2.16±0.81 (1-3)	4.02±1.64 (0-6)	3.00±0.95 (1-4)	20.52±3.63 (11-25)
No children (n=91)	5.80±0.52 (3-6)	5.50±0.72 (4-6)	2.03±0.79 (0-3)	4.51±1.23 (0-6)	3.30±0.90 (1-4)	21.16±2.65 (11-25)
Working time in ED						
One year and below (n=65)	5.82±0.47 (3-6)	5.49±0.73 (4-6)	1.93±0.78 (0-3)	4.72±1.16 (0-6)	3.26±0.92 (1-4)	21.26±2.75 (11-25)
Two years and over (n=62)	5.90±0.31 (4-6)	5.50±0.52 (3-6)	2.30±0.82 (1-3)	4.50±1.17 (0-6)	3.60±0.51 (1-4)	21.80±2.04 (11-25)
Pre-graduation training						
Educated (n=100)	5.85±0.41 (4-6)	5.53±0.70 (4-6)	2.06±0.78 (0-3)	4.50±1.18 (1-6)	3.32±0.90 (1-4)	21.26±2.49 (13-25)
Not educated (n=27)	5.77±0.64 (3-6)	5.29±0.95 (3-6)	2.11±0.84 (1-3)	3.92±1.87 (0-6)	2.85±0.90 (1-4)	19.96±4.20 (11-24)
Post-graduation training						
Educated (n=15)	5.86±0.35 (5-6)	5.86±0.35 (5-6)	2.26±0.79 (1-3)	4.73±1.03 (3-6)	3.20±0.77 (2-4)	21.93±2.34 (19-25)

Table 4. contiuned

Not educated (n=112)	5.83±0.48 (3-6)	5.42±0.79 (3-6)	2.04±0.79 (0-3)	4.33±1.41 (0-6)	3.22±0.94 (1-4)	20.85±3.02 (11-25)
The situation of encountering cases of child abuse						
Encountered (n=73)	5.84±0.43 (4-6)	5.45±0.80 (3-6)	2.10±0.79 (1-3)	4.23±1.37 (0-6)	3.21±0.91 (1-4)	20.86±2.97 (11-25)
Not encountered (n=54)	5.81±0.51 (3-6)	5.51±0.72 (4-6)	2.01±0.81 (0-3)	4.57±1.35 (0-6)	3.22±0.94 (1-4)	21.14±2.97 (11-25)
The most common type of child abuse cases in the ED						
Sexual abuse (n=4)	6.00±0.00 (6-6)	5.00±1.15 (4-6)	2.00±0.81 (1-3)	5.00±1.41 (3-6)	3.25±0.50 (3-4)	21.25±2.06 (19-24)
Emotional abuse (n=13)	6.00±0.00 (6-6)	5.61±0.76 (4-6)	1.92±0.75 (1-3)	4.23±1.36 (2-6)	3.07±0.95 (1-4)	20.84±2.99 (16-24)
Physical abuse (n=38)	5.76±0.54 (4-6)	5.47±0.68 (4-6)	1.97±0.85 (1-3)	4.36±1.28 (1-6)	3.44±0.89 (1-4)	21.02±2.92 (13-25)
Neglect (n=72)	5.83±0.47 (3-6)	5.48±0.78 (3-6)	2.15±0.78 (0-3)	4.37±1.37 (0-6)	3.12±0.94 (1-4)	20.97±3.07 (11-25)
The most common skipped type of child abuse cases in the ED						
Sexual abuse (n=42)	5.90±0.29 (5-6)	5.66±0.65 (4-6)	2.40±0.73 (1-3)	4.40±1.19 (2-6)	3.45±0.83 (1-4)	21.83±2.12 (16-24)
Emotional abuse (n=66)	5.78±0.56 (3-6)	5.37±0.81 (3-6)	1.93±0.78 (0-3)	4.45±1.47 (0-6)	3.12±0.98 (1-4)	20.68±3.30 (11-25)
Physical abuse (n=6)	5.83±0.40 (5-6)	5.16±0.98 (4-6)	1.50±0.54 (1-2)	3.66±1.50 (2-5)	3.16±0.75 (2-4)	19.33±3.14 (16-23)
Neglect (n=13)	5.84±0.37 (5-6)	5.53±0.66 (4-6)	1.92±0.86 (1-3)	4.23±1.36 (1-6)	3.00±0.91 (1-4)	20.53±3.04 (13-24)

ED: Emergency department, SD: Standart Deviation, *p<0.05, min: Minumum, max: Maximum

In a study they conducted on pediatricians and general practitioners, Kara et al. (7) found similar to the results of our study that the most frequently seen cases were neglect with 45.8%, with physical abuse second most frequently seen with a rate of 23.6%. In our country, child abuse is a judicial case that should be reported when diagnosed, and there is a criminal sanction when it is not reported in terms of health professionals according to the item 280 of TPC. This is defined as one year of imprisonment in the penal code. In our study, while 15.7% of the physicians stated that there were no criminal sanctions when no reports were made, 41.7% stated that criminal sanction was one year of imprisonment when no reports were made.

In terms of the question of "your opinions about the existing criminal sanctions in TPC related with sexual abuse crime committed against children", 75.6% of the physicians stated that they found these sanctions as mild, while 8.6% stated that they found these sanctions as severe. Trials about abuse crimes for children include applications that cause discussion before society. These discussions sometimes result from the legislation, sometimes from the verdicts and applications of judicial authorities and sometimes from the attitudes of legal structuring (22). Provisions that organize the crimes against sexual immunity in TPC have been exposed to changes many times since 01/06/2005 when TPC came in force. After the Supreme Court canceled item 103/2 of TPC with the justification that "it cannot be said that the amount of penalty specified is in the rate or extent that will allow the purpose aimed to reach with this penalty. Since the rule predicts an excessive sanction as it is, it is against the principle of law and state", item 103/1 was also canceled with similar justifications (23). After this verdict of the Supreme Court, the real question that caused serious discussions was how to approach crime when the offender of the crime was also a child in crimes committed against sexual immunity (22). When considered in terms of this and other aspects, although the law is sufficient, it may be considered as mild by physicians may be due to differences in practice or as a result of decisions made.

In our study, results parallel to the results of the study conducted in Ankara were found in terms of the scores taken from the

scale (7). It was seen that the scale scores of the female gender and 33 years old and under physician groups were statistically significantly higher in our study. In a study conducted in 1997 in the USA on 393 physicians who were pediatricians, family physicians, and emergency physicians, it was found that adult female participants were more sensitive than male participants in terms of child abuse (24). It is thought that the reason why younger physicians had higher levels of knowledge was the fact that as stated in Demir's thesis, importance and place were given to the issue of "child abuse" in medical faculty curriculums, especially recently (15).

Conclusion

In conclusion, emergency physicians come across child abuse cases more frequently when compared with general practitioners, and they think that their education about child abuse is insufficient. This questionnaire conducted on emergency physicians in the province of Ordu showed that pre- or post-graduate training conducted on the issue could develop physicians' attitudes and behaviors against child abuse cases. Also, it is an important issue that in-hospital coordination should be built and developed between branches related to the issue and emergency services for the multidisciplinary approach required and considered as necessary by emergency physicians. We believe that assessing for abuse in each child examined and cooperating with the related institutions and physicians when having suspicions on the issue can develop a mechanism that can prevent missing cases.

Ethics

Ethics Committee Approval: Ethics committee approval was received for this study from the Ordu University Clinical Researches Ethical Board (decision number: 2018/155).

Informed Consent: Written informed consent was obtained from all participants in this study.

Peer-review: Externally and internally peer-reviewed.

Author Contributions

Concept: A.A, H.Y.T., Design A.A., Data Collection and/or Processing: A.A, H.Y.T., Analysis or Interpretation: A.A, H.Y.T., Literature Search: A.A, H.Y.T., Writing: A.A, H.Y.T.

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Comparison of the McGrath MAC EMS Videolaryngoscope with a Conventional Laryngoscope for Standard and Difficult Airway Intubation: A Randomized, Cross-over, Simulation Trial

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Abstract

Aim: Tracheal intubation is challenging in emergency medicine, especially in pre-hospital settings, owing to problems connected with patients, intubator, and the environment. The study aimed to compare the effectiveness of endotracheal intubation performed by paramedics with the use of direct laryngoscopy and the McGrath MAC videolaryngoscope in standard and difficult airway settings.

Materials and Methods: The study was designed as a prospective, randomized, cross-over simulation study. It involved 52 paramedics. The participants performed endotracheal intubation in two scenarios: Normal airway and difficult airway, achieved by inflation of the simulator tongue to the level of difficulty determined by an independent instructor at grade 3 on the Cormack-Lehane scale. The primary endpoint was the success of endotracheal intubation; intubation time constituted the secondary endpoint.

Results: The median age of participants was 24 years [interquartile range (IQR): 23-25], and the median work experience was 0.5 years (IQR: 0-1). In normal airway (scenario A), the effectiveness of the first intubation attempt was 92.3% for MAC and 96.2% for McGrath (p=0.724). The median intubation time for MAC was 19 (IQR: 14-21.5) seconds and was statistically significantly longer than 16 (12.5-20) seconds for McGrath (p=0.047). The ease of intubation was 18 (IQR: 10-20) points for McGrath and 25 (IQR: 16-27) points for MAC (p=0.035). In difficult airway (scenario B), the efficacy of the first intubation attempt for MAC and McGrath equaled 40.4% and 82.7%, respectively. The median intubation time for McGrath was 19 (IQR: 14-27.5) seconds and was significantly shorter than 25 (IQR: 24-39) seconds for MAC (p=0.007). The degree of glottis visualization was statistically significantly better in McGrath than in MAC (p<0.001). The ease of intubation was 25 (IQR: 20-32) points for McGrath and 49 (IQR: 34-58) points for MAC (p<0.001). Overall, 96.2% of subjects intubating in difficult airway conditions chose the McGrath videolaryngoscope as their preferred intubation method as compared with MAC.

Conclusion: In the simulation study, endotracheal intubation in difficult airway conditions performed by paramedics using McGrath video laryngoscopy was associated with shorter procedure duration, better glottis visualization, and higher efficacy of the first intubation attempt. The study showed that paramedics were able to intubate using the McGrath videolaryngoscope with higher efficiency than in the case of a standard Macintosh laryngoscope after a short training.

Keywords: Airway management, McGrath MAC EMS, difficult airway, videolaryngoscopy, simulation

Introduction

Tracheal intubation is the gold standard for airway management. The advantages of endotracheal intubation include reliable ventilation, separation of the airway from the gastrointestinal tract, significant reduction of regurgitation risk, the possibility to suction the respiratory tract, and to ventilate in further patient care conditions, including intensive care units (1,2). Endotracheal intubation can be performed with many techniques, but direct

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laryngoscopy is usually applied. This method, however, requires appropriate experience, and many intubation attempts to maintain an adequate level of experience and manual skills (3). Because of the risk of severe and potentially fatal complications associated with endotracheal intubation, it is necessary to consider the experience, necessity of endotracheal intubation, technical possibilities, and alternative methods. Considering the above problems, the quality of intubation, including the effectiveness of the first intubation attempt, the assessment of complication risk, and the total duration of intubation procedure have been studied for several years (4,5).

Tracheal intubation is challenging in emergency medicine, especially in pre-hospital settings, owing to problems connected with the patient, intubator, and environment (6,7). Performing endotracheal intubation in the case of sudden cardiac arrest in a patient with difficult airways by a relatively inexperienced professional in unfavorable environmental conditions is associated with a very high risk of esophageal intubation and other complications (8).

The development of videolaryngoscope marked significant progress in anesthesiology and emergency medicine (9,10). The devices enable endotracheal intubation even when the entrance to the larynx cannot be directly visualized (11). Videolaryngoscope is used not only in elective cases in the operating theatre during difficult intubation but also in emergency medicine (12). Many surveys, including manikin studies and human studies (13,14), indicate that the duration of endotracheal intubation is shorter compared with direct laryngoscopy, especially in difficult airways, as this is not always confirmed in the case of normal airways (14). Although in critical care settings, in patients undergoing endotracheal intubation, videolaryngoscopy improves glottic visualization, it does not appear to increase procedural success or decrease complications (15). Large clinical multicenter studies were carried out to compare videolaryngoscope and direct laryngoscopy (14).

One of the available videolaryngoscope on the market is the McGrath MAC EMS videolaryngoscope. It combines direct laryngoscopy and videolaryngoscopy in one device. Many intubators, especially emergency medical service providers, have greater experience with direct laryngoscopy. McGrath MAC EMS enables both direct visualization and videolaryngoscopy and can facilitate intubation.

The study aimed to compare the effectiveness of endotracheal intubation performed by paramedics with the use of direct laryngoscopy and the McGrath MAC videolaryngoscope in standard and difficult airway settings.

Materials and Methods

The study protocol was approved by the Institutional Review Board of the Polish Society of Disaster Medicine (number: 23.02.2019.IRB, on 12.02.2019). The study is a continuation of research on identifying an alternative intubation method to direct laryngoscopy (16-19). The trial was designed as a prospective, randomized, cross-over manikin study. Written informed consent was obtained from all 52 paramedics taking part in the study. All subjects had <1 year of experience and had performed <10 endotracheal intubations in real patients. None of them had previously had any experience with the use of videolaryngoscopy.

Study Design

Before the study, all participants attended an airway management workshop, which included endotracheal intubation with the use of direct laryngoscopy and videolaryngoscopy. Two types of laryngoscopes were used in the study:

1. Standard laryngoscope with Macintosh blade size 3 (gold standard; Heine Optotechnik, Herrsching, Germany);

2. McGrath MAC EMS videolaryngoscope (Aircraft Medical Limited, Edinburgh, Scotland; Figure 1).

After an instruction showing the correct intubation technique, the subjects took part in 30 minute practical workshops with the use of the studied devices. The training took place in normal airway conditions; an airway manikin Ambu Airway Man (Ambu, Copenhagen, Denmark) was involved.

During the target study, an advanced adult SimMan 3G simulator (Laerdal, Stavanger, Norway) was applied to simulate a patient requiring endotracheal intubation. The simulator was placed on the floor in a room with daylight. The study participants performed endotracheal intubation in 2 scenarios:

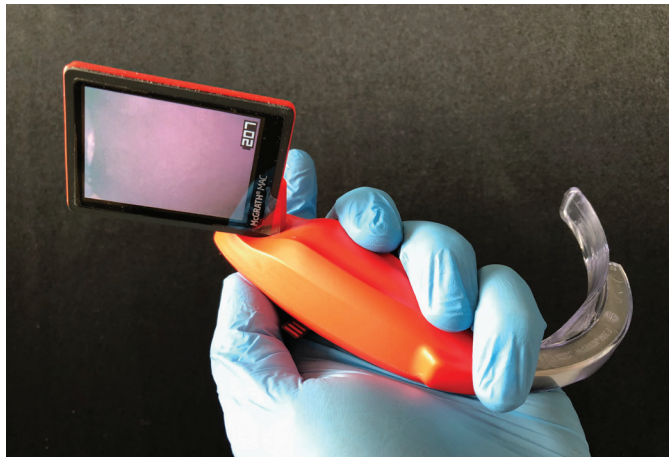

Figure 1. McGrath MAC EMS videolaryngoscope

1. Scenario A: Normal airway.

2. Scenario B: Difficult airway. Difficult airways were achieved by inflation of the simulator tongue to the level of difficulty determined by an independent instructor at grade 3 on the Cormack-Lehane scale (20).

A standard intubation stylet was used for all intubations. The participants had a maximum of 3 endotracheal intubation attempts. The order of both subjects and research methods were random. For this purpose, Research Randomizer (randomizer.org) was used to divide the participants into 4 groups: the first one performed endotracheal intubation by using MAC during scenario A, the second one by using MAC during scenario B, the third one by using McGrath in scenario A, and the fourth one by using McGrath during scenario B. After the intubation attempts with a given method, the participants had a 10-minute break and then intubated with a different technique. The detailed randomization procedure is presented in Figure 2.

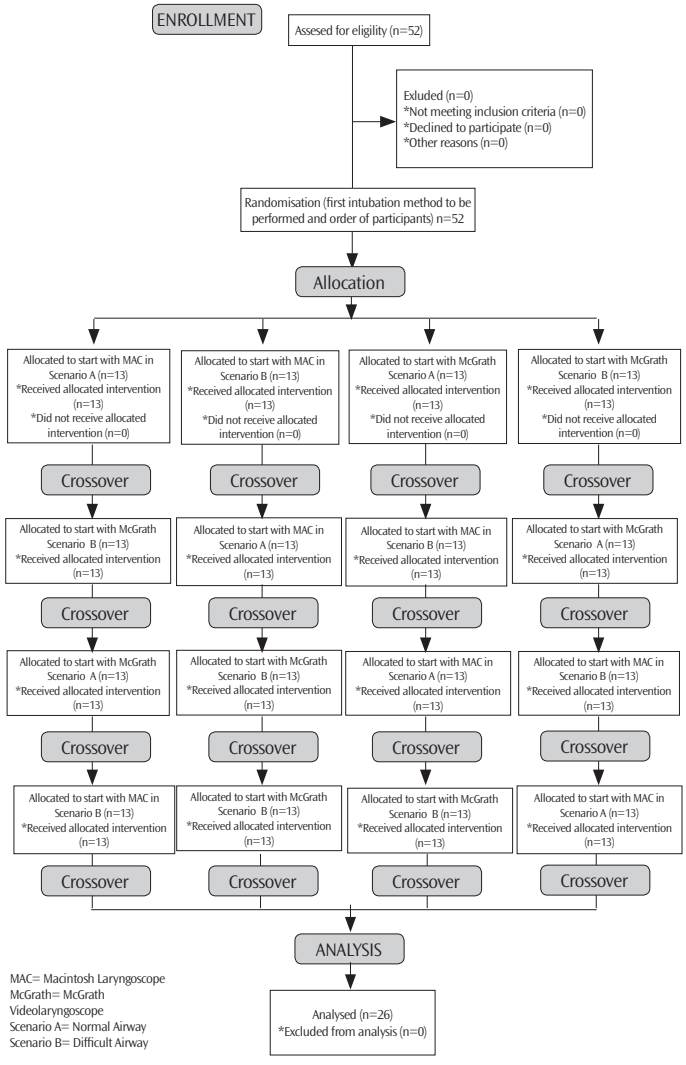

Figure 2. Randomization flow chart

Measurements

The primary endpoint was the success of endotracheal intubation, confirmed by a researcher by the ability to ventilate the manikin lungs with a self-inflating bag connected to the endotracheal tube. The following criteria were defined for a failed intubation: more than three unsuccessful intubation attempts, intubation procedure exceeding 120 seconds, unrecognized esophageal intubation.

Intubation time, the secondary endpoint, was defined as the time from the first insertion of the blade between the teeth until the first successful ventilation of the lungs recorded with a stopwatch of a mobile phone. Vocal cord visualization was assessed by Cormack-Lehane grade (20). The paramedics' subjective opinion on the ease of use of each device was measured with a visual analog scale ranging from 1 (extremely easy) to 100 (extremely difficult). Finally, the participants were asked to indicate the device that they would prefer in a real-life emergency intubation setting.

Statistical Analysis

All analyses were performed with the STATISTICA 13.3EN statistical package (Tibco, Tulsa, OK, USA). We determined the sample size based on a previous study calculation (21). In the context of using a paired 2-sided t-test, accepting an α risk of $p<0.05$, powered to 80%, 46 participants were required.

Data are presented as number (percentage) or median [interquartile range (IQR)]. Non-parametric tests were used for the data that did not have a normal distribution. The Wilcoxon test for paired observations was applied to compare the different times and to determine the statistical difference for each group. McNemar test served to evaluate the differences in intubation success rates and Cormack-Lehane grade. The ease-of-use scale, as well as the preferred airway device, were assessed with the Stuart-Maxwell test. All tests were 2-sided, and the value of $p<0.05$ was considered statistically significant.

Results

The study involved 52 paramedics with a median age of 24 years (IQR: 23-25) and a median work experience of 0.5 years (IQR: 0-1). None of the subjects had experience with videolaryngoscopy; however, they all had clinical experience with direct laryngoscopy.

Normal Airway (Scenario A)

The effectiveness of the first intubation attempt was 92.3% for MAC and 96.2% for McGrath ($p=0.724$). The median intubation time for MAC was 19 (IQR: 14-21.5) seconds and was statistically significantly longer than 16 (12.5-20) seconds for McGrath ($p=0.047$; Figure 3). The analysis of the study material did not

reveal statistically significant differences in the degree of glottis visualization expressed on the Cormack-Lehane scale (Table 1). The ease of intubation was 18 (IQR: 10-20) points for McGrath and 25 (IQR: 16-27) points for MAC (p=0.035; Figure 4). Overall, 31 subjects, which accounted for 59.6% of the study group, indicated McGrath as their preferred method of laryngoscopy.

Difficult Airway (Scenario B)

A detailed summary of scenario B results is presented in Table 2. The efficacy of the first intubation attempt for MAC and McGrath equaled 40.4% and 82.7%, respectively. The median intubation time for McGrath was 19 (IQR: 14-27.5) seconds and was significantly shorter than 25 (IQR: 24-39) seconds for MAC (p=0.007; Figure 3). The degree of glottis visualization was statistically significantly better in McGrath than in MAC (p<0.001). The ease of intubation was 25 (IQR: 20-32) points for McGrath, and 49 (IQR: 34-58) points for MAC (p<0.001; Figure 4). Overall, 50 (96.2%) subjects intubating in difficult airway conditions chose the McGrath videolaryngoscope as their preferred intubation method as compared with MAC.

Discussion

The simulation study showed statistically significant differences in the duration of the intubation procedure and the efficacy of the first intubation attempt when using a standard Macintosh blade laryngoscope and the McGrath MAC EMS videolaryngoscope.

Endotracheal intubation in pre-hospital settings can be challenging even for experienced intubators (22,23). It should be remembered that each intubation performed within an emergency medical service is emergency intubation (24). The lack of information on patient status and medical history, inability to conduct an anesthesia consultation in many cases, as well as the lack of knowledge of the recent meal, make each patient in the pre-hospital conditions and the emergency department considered as a patient with difficult airways (25).

Table 1. Normal airway (scenario A)

Parameter	Direct laryngoscopy (MAC)	Videolaryngoscopy (McGrath)	p
Overall success rate, n (%)	52 (100%)	52 (100%)	NS
Number of intubation attempts, n (%)			
1	48 (92.3%)	50 (96.2%)	
2	4 (7.7%)	2 (3.8%)	NS
3	-	-	
The median time to intubation, s (IQR)	19 (14-21.5)	16 (12.5-20)	0.047
Cormack-Lehane grade, n (%)			
1	46 (88.5%)	52 (100%)	
2	6 (11.5%)	-	NS
3	-	-	
4	-	-	
Ease of intubation, points on a 1-100 scale (IQR)	25 (16-27)	18 (10-20)	0.035
Preferred airway device, n/52 overall	21/52	31/52	0.011

IQR: Interquartile range, NS: Not statistically significant, MAC: Macintosh laryngoscope

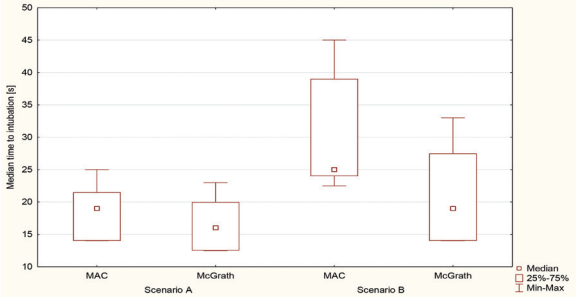

Figure 3. Median intubation time

Min: Minimum, Max: Maximum, MAC: Macintosh laryngoscope

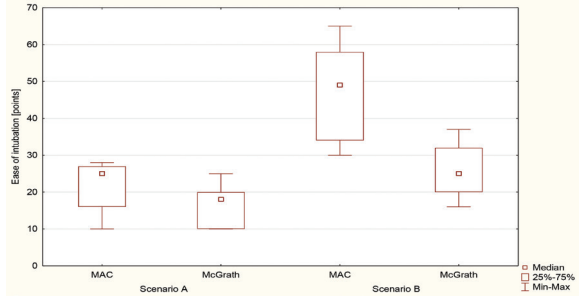

Figure 4. Ease of intubation

Min: Minimum, Max: Maximum, MAC: Macintosh laryngoscope

Table 2. Difficult airway (scenario B)

Parameter	Direct laryngoscopy (MAC)	Videolaryngoscopy (McGrath)	p
Overall success rate, n (%)	52 (100%)	52 (100%)	NS
Number of intubation attempts, n (%)			
1	21 (40.4%)	43 (82.7%)	<0.001
2	31 (59.6%)	9 (17.3%)	
3	-	-	
The median time to intubation, s (IQR)	25 (24-39)	19 (14-27.5)	0.007
Cormack-Lehane grade, n (%)			
1	-	50 (96.2%)	<0.001
2	2 (3.8%)	2 (3.8%)	
3	48 (92.3%)	-	
4	2 (3.8%)	-	
Ease of intubation, points on a 1-100 scale (IQR)	49 (34-58)	25 (20-32)	<0.001
Preferred airway device, n/52 overall	2/52	50/52	<0.001

IQR: Interquartile range, NS: Not statistically significant, MAC: Macintosh laryngoscope

In our study, the efficacy of the first intubation attempt and the total efficacy of intubation under normal airway were comparable for direct laryngoscopy and McGrath videolaryngoscopy. Additionally, in normal airway conditions, the glottis visualization was slightly better with McGrath than with Macintosh. Liu et al. (26) also indicate that the use of the McGrath laryngoscope by inexperienced anesthesiologists may improve the visibility of the glottis and the ease of the procedure and reduce the number of complications compared with direct laryngoscopy. Walker et al. (27) found no advantages of using the McGrath laryngoscope for uncomplicated tracheal intubation, but it is worth mentioning that anesthesiologists in their study performed intubation. On the other hand, studies conducted by Szarpak et al. (21) under normal airway conditions showed that the overall effectiveness of the UEScope and Macintosh laryngoscope was comparable, but in the case of the videolaryngoscope, paramedics were less likely to exert pressure on the teeth. In a prospective cohort study conducted at a simulation center of a university-based, tertiary care hospital, Kaki et al. (28) indicated that videolaryngoscope was better than the regular Macintosh when used by novice medical students for oral and nasal intubation in a manikin. Similar conclusions were expressed by other researchers (29).

Difficult airways can result from a variety of causes, including tongue edema, cervical spine immobilization, or difficult access to the patient. In all these situations, it is expected that the effectiveness of the first intubation attempt will be reduced, and the duration of the procedure will be prolonged with a MAC (12,30,31). In the study, both the efficacy of the first intubation attempt and the duration of the procedure were significantly better with a videolaryngoscope than with a standard Macintosh blade laryngoscope.

In a study by Owada et al. (32) in which 20 anesthesiologists performed intubation in difficult airway conditions of a pediatric patient showed that the subjects were able to perform intubations using an Airtraq® videolaryngoscope with a higher success rate, better visibility, and less dental trauma. In turn, Suzuki et al. (12), in their retrospective cohort study, indicated that the Pentax and McGrath laryngoscopes allowed for significantly higher emergency endotracheal intubation first-pass success rates compared with the Macintosh laryngoscope, especially among non-expert operators. Yoo et al. (33) revealed an advantage of McGrath and Macintosh laryngoscopes for double-lumen endobronchial tube intubation in patients with manual in-line stabilization.

Another significant result of the research is the fact that paramedics were able to intubate using a videolaryngoscope after short training effectively. In the case of direct laryngoscopy, the learning curve, as shown by numerous studies, illustrates 43-75 attempts required for achieving successful intubation (34-36). The present study indicates an acceleration of the learning curve with videolaryngoscopy, and this is also confirmed in studies by Baciarello et al. (37), Aghamohammadi et al. (38), and other authors (13,39,40).

Among the limitations of the conducted study, one can mention, among others, the fact that it was carried out in the conditions of medical simulation and not real rescue operations; this was, however, a deliberate action because medical simulation allows standardizing the performed procedures (41,42) fully. Another reason for choosing medical simulation was that only this method allows conducting randomized cross-over studies without a potential detriment to the health and life of the patient

(43). A further limitation is that only paramedics were involved in the study. Nevertheless, it is paramedics acting in emergency medical service settings who may meet the need for endotracheal intubation relatively often. Therefore, the evaluation of their skills, as well as the search for methods of intubation alternative to direct laryngoscopy, pose a challenge to researchers. The study also has its strong points. Among them are its randomized, cross-over character and the use of two methods of laryngoscopy.

Conclusion

In the simulation study, endotracheal intubation in difficult airway conditions performed by paramedics using McGrath video laryngoscopy was associated with shorter procedure duration, better glottis visualization, and higher efficacy of the first intubation attempt. The study showed that after a short training, paramedics were able to intubate using the McGrath videolaryngoscope with higher efficiency than in the case of a standard Macintosh laryngoscope.

Ethics

Ethics Committee Approval: The study protocol was approved by the Institutional Review Board of the Polish Society of Disaster Medicine (approval no. 23.02.2019.IRB, 12.02.2019).
Informed Consent: Written informed consent was obtained from all 52 paramedics taking part in the study.

Peer-review: Externally and internally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: L.S., J.S., D.G., Concept: L.S., T.E., Design: L.S., T.E., Data Collection or Processing: L.S., J.S., D.G., Analysis or Interpretation: L.S., Literature Search: S.K., J.S., B.K., D.G., Writing: S.K., L.S., T.E., J.S., B.K., D.G.

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Evaluation of Hemodialysis and Hemoperfusion in Poisoned Patients

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Abstract

Aim: The aim of our study was to evaluate the demographic data, type of toxic substance, Glasgow Coma scale (GCS), Poisoning Severity score (PSS) and the prognosis of the patients who were admitted to the emergency department (ED) with a preliminary diagnosis of acute intoxication and then underwent hemodialysis (HD) or hemoperfusion (HP), and to compare this data with other studies.

Materials and Methods: The study retrospectively analyzed the files of 36 poisoned patients who were admitted to the ED and who underwent HD or HP by using the hospital electronic data system.

Results: HD was administered to 27 patients (75.0%) and HP was administered to nine patients (25.0%). Among the patients treated with HD, five (18.5%) were poisoned by valproic acid, one (3.7%) by amlodipine, one (3.7%) by organic phosphorus, one (3.7%) by paracetamol, four (14.8%) by mushroom, two (7.4%) by ethyl alcohol/ethanol, three (11.2%) by lithium and ten (37.0%) by methyl alcohol/methanol. Among the patients treated with HP, one (11.1%) was poisoned by organic phosphorus, seven (77.8%) by amitriptyline, and one (11.1%) by phenytoin. The median GCS score was 10, and the median PSS was 3. The deceased patients had significantly lower GCS scores while their PSS was significantly higher. Eleven patients died, and 25 patients were discharged with full recovery.

Conclusion: This is a multifaceted study that investigated poisoned patients treated with HD or HP and presented treatment modalities that are currently used, and we think they will be used more widely in the future.

Keywords: Hemodialysis, hemoperfusion, poisoned, prognosis

Introduction

Substances that disrupt the vital functions of the organism when a certain amount enters the body are called toxic substances. When such substances harm the body, it is called intoxication. Poisoning cases are quite common all over the world. In the United States, more than 5 million people are being treated due to exposure to biological or chemical agents each year. According to descriptive research data from the studies in Turkey, acute intoxication cases that applied to emergency departments (ED) are 0.3-5% among all the applications to the ED. Pesticides, cleaning products and carbon monoxide intoxications are observed in decreasing frequency, respectively. Analgesics constitute the majority of the medications that cause acute intoxication, and this is followed by sedative-hypnotics and antidepressants, respectively (1).

After stabilization of the patient, the purpose of the treatment is to apply procedures towards the poison. The general approach to toxic exposure cases involves keeping away the patient from the substance and removing the substance from the patient. Extracorporeal treatments (ECTR) are used to remove toxic substances from the body of intoxicated patients. ECTR methods include dialysis [hemodialysis (HD), modified forms of HD, and peritoneal dialysis], hemoperfusion (HP), exchange transfusion, and plasmapheresis. Today, ECTRs are mostly used for methanol, ethylene glycol, lithium, salicylate, and phenobarbital poisoning (2-4).

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HD is mainly based on diffusion. There is an exchange of solutes between the blood and the dialysate separated by the membrane (5). HP refers to the process by that the blood is passed through a cartridge containing activated charcoal or carbon (6).

The aim of the our study was to evaluate the demographic data, type of toxic substance, Glasgow Coma scale (GCS), Poisoning Severity score (PSS) and the prognosis of the patients who were admitted to the ED with a preliminary diagnosis of acute intoxication and then underwent HD or HP, and to compare this data with other studies.

Materials and Methods

Between January 2006 and December 2013, 5, 998 acute poisoning cases were admitted to the ED of Ondokuz Mayıs University Hospital, and 40 of them underwent HD or HP. This study retrospectively examined the files of 40 poisoned patients who underwent HD or HP. Three patients were excluded from the study due to multiple drug intake and one patient due to multiple drug intake and chronic kidney failure. Patients aged less than 18 years were also excluded from the study. The study was approved by the Clinical Research Ethics Committee of Ondokuz Mayıs University (OMU KAEK resolution no: 2014/853).

The following data were retrieved from the patient files and the hospital electronic data system: Name, surname, age, gender, the history of previous systemic disease and suicide attempt, the cause of intoxication (drinking medicines or pesticides, eating mushrooms, and methanol or ethanol intake), GCS and PSS at admission and the outcome (death or discharge with full recovery). The degree of intoxication was rated according to the GCS and PSS at the time of admission.

PSS was applied to the most severe symptomatology. Severity grades of PSS were described as:

None (grade 0): No symptoms or signs related to poisoning,

Minor (grade 1): Mild, transient, and spontaneously resolving symptoms,

Moderate (grade 2): Pronounced or prolonged symptoms,

Severe (grade 3): Severe or life-threatening symptoms,

Fatal (grade 4): Death.

Nephrology consultation notes were available in all patient files and the indications for HD or HP were grouped as follows:

- to enhance the elimination of toxins,

- the development of acute kidney failure during the follow-up,

- the development of acute liver failure during the follow-up,

- unresponsive metabolic acidosis and altered states of consciousness despite supportive care.

Statistical Analysis

The data were analyzed using IBM SPSS statistical software (version 22.0, SPSS, Inc., Chicago, IL). The descriptive statistics were presented as mean ± standard deviation, median (minimum-maximum), frequency distribution, and percentage. Additionally, the chi-square test and Fisher's exact test were also used. The normality of variables was examined using histograms, probability graphs, and the tests of normality (the Kolmogorov-Smirnov test and Shapiro-Wilk test). The Mann-Whitney U test was used to test that of non-normally distributed variables. The level of statistical significance was set at $p<0.05$.

Results

The mean age of 36 patients was 40.1±17.9 years, and the median was 37 (range: 18-80). Twenty patients (55.6%) were male. The median GCS score was 10 (range: 3-15), and the median PSS was 3 (range: 1-3).

Among the patients admitted to the ED due to poisoning and treated with HD, five (18.5%) were poisoned by valproic acid, one (3.7%) by amlodipine, one (3.7%) by organic phosphorus, one (3.7%) by paracetamol, four (14.8%) by mushroom, two (7.4%) by ethanol, three (11.2%) by lithium, and ten (37.0%) by methanol. Among the patients treated with HP, one (11.1%) was poisoned by organic phosphorus, seven (77.8%) by amitriptyline, and one (11.1%) by phenytoin (Table 1).

Table 1. Distribution of hemodialysis/hemoperfusion among the patients

	Treatment			
	Hemodialysis		Hemoperfusion	
	n	%	n	%
Valproic acid	5	18.5	0	0
Amlodipine	1	3.7	0	0
Organic phosphorus	1	3.7	1	11.1
Amitriptyline	0	0	7	77.8
Paracetamol	1	3.7	0	0
Mushroom	4	14.8	0	0
Ethanol	2	7.4	0	0
Lithium	3	11.2	0	0
Methanol	10	37.0	0	0
Phenytoin	0	0	1	11.1
Total	27	100	9	100

Among the patients treated with HD or HP to enhance elimination, ten (35.7%) were poisoned by methanol, seven (25.0%) by amitriptyline, five (17.9%) by valproic acid, three (10.7%) by lithium, two (7.1%) by mushroom, and one (3.6%) by phenytoin. Among the patients who underwent HD or HP and developed kidney failure during the treatment, one (33.3%) was poisoned by amlodipine, one (33.4%) by organic phosphorus, and one (33.3%) by paracetamol. Among the patients who underwent HD or HP and developed liver failure during the treatment, two (100%) were poisoned by mushroom. Among the patients who underwent HD or HP due to unresponsive metabolic acidosis and altered states of consciousness despite supportive care during the follow-up, two (66.7%) were poisoned by ethanol and one (33.3%) by organic phosphorus (Table 2).

The median GCS score at the time of admission was 3 (range: 3-15) for the deceased patients, and 13 (range: 3-15) for the patients discharged with full recovery. This difference was statistically significant (p=0.011).

The median PSS at the time of admission was 3 (range: 3-3) for the deceased patients and 2 (range: 1-3) for the patients discharged with full recovery. This difference was also statistically significant (p=0.001).

Among the patients who were treated with HD or HP to enhance elimination, five (17.8%) died, and 23 (82.1%) were discharged with full recovery. Among those treated with HD or HP for other reasons, six (75.0%) died, and two (25.0%) were discharged with full recovery. There was a statistically significant difference between the prognosis groups in terms of the indications for administering HD or HP (p=0.005).

Considering the distribution of prognosis, 11 (30.6%) patients died, and 25 (69.4%) were discharged with full recovery.

Discussion

Poisoning cases constitute an essential part of the patients admitted to the ED. Although a limited number of patients need HD or HP in poisoning, these treatments are life-saving when necessary. Although ECTR remain in the background due to clinical deficiency and inefficacy, they are an essential part of toxicology. In our study, 5.998 patients were admitted to the ED due to acute intoxication over a 7-year period, and 40 (0.6%) of them were treated with HD or HP. In the literature, the rate of ECTR in acute intoxications has been reported as 0.1% (7). In this respect, we think that the number of patients who underwent HD and HP for poisoning was not low compared with the literature.

The male patients composed 55.6% of the cases. In the multicenter study of Taghaddosinejad et al. (8), the male patients composed 57% of the cases.

Taghaddosinejad et al. (8) and Lund et al. (9), who studied 1.065 cases, reported that the incidence of poisoning had its peak in the third decade of life. We think that the main reason why there is no significant difference in age distributions in our study is the low number of cases.

In our study, 27 (75.0%) patients underwent HD and nine (25.0%) underwent HP. Methanol poisoning consituted the largest group with ten patients, which was followed by amitriptyline poisoning with seven patients. Mardini et al. (10) reviewed all cases that underwent ECTR and reported that 294 (61.0%) cases underwent HD, and 52 (12.2%) underwent HP during the period from 2010 to 2014. During that period, the majority of patients who underwent ECTR consisted of cases of metformin poisoning, which were followed by cases of methanol poisoning. During the period from 2000 to 2009, the majority of patients

Table 2. Distribution of hemoperfusion/hemodialysis treatment indications

	The indications of hemoperfusion/hemodialysis			
	Enhance elimination (%)	Kidney failure (%)	Liver failure (%)	Metabolic acidosis and altered states of consciousness (%)
Valproic acid	5 (17.8)	0	0	0
Amlodipine	0	1 (33.3)	0	0
Organic phosphorus	0	1 (33.4)	0	1 (33.3)
Amitriptyline	7 (25.0)	0	0	0
Paracetamol	0	1 (33.3)	0	0
Mushroom	2 (7.1)	0	2 (100)	0
Ethanol	0	0	0	2 (66.7)
Lithium	3 (10.7)	0	0	0
Methanol	10 (35.7)	0	0	0
Phenytoin	1 (3.6)	0	0	0
Total	28	3	2	3

who underwent ECTR consisted of cases of methanol poisoning. In their study, among all ECTR cases, 51.7% underwent HD, and 25.7% underwent HP, while the percentage of HD compared to other techniques increased steadily every year. Compared to their data of the period from 2010 to 2014, the reason that HP had a high percentage in our study was that HP was used for the treatment of amitriptyline poisoning, which composed the second largest group of our cases. However, Mardini et al. (10) reported that ECTR was used in none of the amitriptyline poisoning cases after 1990.

In their multicenter study, Darracq and Cantrell. (11) found that among 90 pediatric and adolescent poisoning cases, ECTR was performed in 78 (86.6%) cases for enhanced elimination, in 12 (13.3%) cases due to the development of kidney failure, and in three (3.3%) cases due to unclear indications. In our study, the reasons for administering HD or HP were as follows: 28 (7.7%) patients were administered HD or HP to enhance elimination, three (8.4%) developed renal failure, two (5.5%) developed liver failure, and three (8.4%) had unresponsive metabolic acidosis and an altered state of consciousness despite supportive care. In agreement with the finding of Darracq and Cantrell (11), the most frequent indication was also enhanced elimination in our study. Additionally, we observed that HD or HP performed for enhanced elimination compared to other indications led to a better prognosis in terms of survival outcomes. The mortality rate was 17.8% in the use of HD or HP for enhanced elimination, while it was 75% in the use of HD or HP for other reasons or indications. No previous study has evaluated prognosis in terms of indications for the use of HD or HP. Therefore, more research is needed to make correct interpretations.

We evaluated the patients according to their GCS score and PSS at the time of admission. The median GCS score at admission was 10, and the median PSS was 3. Concerning prognosis, the median GCS and the median PSS were 3 in the deceased patients, while they were 13 and 2, respectively, in the discharged patients. This finding match those observed in earlier studies. In the study by Churi et al. (12), the mean GCS was 12.7±2.4, and the mean PSS was 1.5±0.7 in 212 severe poisoning cases in India. In the same study, the mean GCS was 6.2±1.3, and the mean PSS was 4.0±0.0 in the deceased group, while the mean GCS was 13.4±1.8 and the mean PSS was 1.5±0.3 in the discharged group. In their study involving 71 organophosphate and carbamate poisoning patients in India, Sam et al. (13) reported that the mean GCS was 6.6±3.6 in the deceased cases and 10.8±3.6 in the discharged cases and the difference was significant. In their study, the mean PSS was 4.0±0 in the deceased cases and 2.5±0.7 in the discharged cases. Consistent with the literature, we found that the lower the GSC and the higher the PSS were at the time of admission, the higher the mortality rate.

In our study, all 36 patients were monitored in the intensive care unit (ICU), and 30.6% had a mortal course. In Taghaddosinejad et al. (8), 17.7% of 175 patients monitored in the ICU died. The mortality rate was lower in some other studies (13,14). The mortality rate in our study was quite high compared to those reported in earlier studies. A possible explanation for this might be that the study population consisted of critical patients undergoing HD or HP. This result may also be explained by the fact that this study was conducted in a regional reference hospital and included only severe poisoning cases.

Study Limitations

The most important limitation of this study was the small number of patients.

Conclusion

Consequently, this study serves as a preliminary study that has investigated intoxicated patients that were treated with HD or HP in a multifaceted manner and presented treatment modalities that are currently being used and that we think that will be used more widely in the future. Since similar studies do not exist in our country, we can say that our study is essential in terms of shedding light on the studies to be carried out from now on.

Ethics

Ethics Committee Approval: The study was approved by the Clinical Research Ethics Committee of Ondokuz Mayıs University (OMU KAEK Resolution no: 2014/853).

Informed Consent: This is a retrospective study in which patients' identity information is not used.

Peer-review: Externally and internally peer-reviewed.

Author Contributions

Concept: B.G., C.K., F.K., Design: B.G., C.K., F.K., Data Collection or Processing: B.G., C.K., F.K., Analysis or Interpretation: B.G., C.K., F.K., Literature Search: B.G., C.K., F.K., Writing: B.G., C.K., F.K.

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A Case Report: Life Saving Mallory-Weiss Syndrome

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Abstract

Mallory-Weiss syndrome is characterized by a mucosa rupture on the gastroesophageal junction and usually associated with intense retching, cough, straining, or vomiting. Methanol intoxication is a cause for severe mortality and morbidity. We aimed to emphasize the lifesaving importance of history taking, rapid diagnosis, and treatment for Mallory-Weiss syndrome secondary to methanol intoxication in the present case. A 54-year old male patient admitted to the emergency service by ambulance with the complaint of bloody vomiting. The patient's overall condition was moderate, and he was confused. He was taken into the resuscitation room. The patient was admitted to urgent endoscopy because of active bleeding. It was detected that he had drunk the alcohol that he made at home and presented bloody vomiting when he woke up in the morning. The patient was diagnosed with methanol intoxication and upper gastrointestinal system (GIS) bleeding. After intravenous infusion of 10 mL/kg loading dose of 10% ethanol, infusion continued by 1.5 mL/kg/hour. Urgent hemodialysis was implemented after infusion of 1 mEq/kg $NaHCO_3$ into the patient presenting severe acidosis. The patient was admitted for further tests and treatment after hemodialysis; he was discharged by cure after nine days. Mallory-Weiss syndrome may develop in GIS bleeding cases triggered by vomiting and have mortal causes. The complaints that start with severe vomiting may be caused by fatal conditions such as methanol intoxication like in the present case. Therefore, a detailed patient history, as well as rapid diagnosis and treatment by emergency clinicians, have vital importance.

Keywords: Mallory-Weiss syndrome, bleeding, methanol, intoxication, toxicology

Introduction

Mallory-Weiss syndrome, which is characterized by bleeding as a result of mucosa rupture on the gastroesophageal junction, is the cause of 1% to 4% of the cases with upper gastrointestinal system (GIS) bleeding. This syndrome is usually associated with intense retching, cough, straining, or vomiting (1). The syndrome was first identified by Kenneth Mallory and Soma Weiss in 1929 (2). This condition may be detected at any age; however, it is more common in the middle age and male gender by 2 to 4 folds (3). Excessive alcohol intake was detected in 40% to 80% of the patients diagnosed with Mallory-Weiss syndrome (4).

Methanol is a colorless and odorless alcohol type that is liquid at room temperature, and mortality and morbidity rates are higher in case of intoxication (5). The metabolites of methanol, formaldehyde, and formic acid are responsible for toxic side effects such as metabolic acidosis, blindness, hemodynamic instability, and death (6). The cases with methanol intoxication may refer to emergency service by complaints of the central nervous system (CNS) depression, visual disorders, abdominal pain, vomiting (7).

We aimed to emphasize the lifesaving importance of history taking, rapid diagnosis, and treatment for Mallory-Weiss syndrome secondary to methanol intoxication in the present case.

Case Report

A 54-year old male patient presenting bloody vomiting was taken to emergency service by ambulance. The patient's overall condition was moderate, and he was confused. He was taken

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into the resuscitation room. Blood pressure was 100/60 mmHg; pulse was 118/min; respiration count was 20/min; SpO_2 was 92%. Physical examination was normal except tenderness in the epigastric region. The patient had no visual disorder before admitting to E.D. No bleeding was detected in rectal examination. Intravenous (IV) access was provided; 0.9% physiological saline, 80 mg pantoprazole, and antiemetic agent were infused; laboratory analysis was ordered simultaneously. Since the patient has active bleeding, he was taken to urgent endoscopy. Mucosa rupture was detected on the gastroesophageal junction by endoscopy, and endoscopic hemoclips were applied for treatment (Figure 1). Laboratory analysis revealed the following; blood gas pH=7.04, pO_2=47.3 mmHg, pCO_2=23.3 mmHg, HCO_3=6.3 mEq/dL, BE=-22.6 anion gap=24.8. Biochemistry analysis was detected as follows: Urea=42 mg/dL, creatinine=1.42 mg/dL, white blood cell=19.300/mm^3, hemoglobin=9.9 gr/dL, platelet=142.000. Other laboratory parameters were normal. The patient's history revealed that he drank homemade alcohol at home the day before; and that he had nausea and vomiting the next morning, and then the bleeding started. The patient was diagnosed with methanol intoxication and upper GIS bleeding (Mallory-Weiss syndrome). Blood methanol levels could not be analyzed in our hospital. After IV infusion of 10 mL/kg loading dose of 10% ethanol, infusion continued by 1.5 mL/kg/hour. Urgent hemodialysis was implemented after infusion of 1 mEq/kg $NaHCO_3$ into the patient presenting severe acidosis. He was admitted for further tests and treatment after hemodialysis. The patient with no present bleeding and visual disorder was discharged in a cured state following three sessions of dialysis treatment.

Discussion

Methanol intoxication bears a higher risk of death due to the delay in referral and diagnosis (5). There may be a silent, symptom-free period for 40 minutes to 72 hours in the clinical presentation of methanol intoxication. At the end of the silent period, the patients may suffer headaches, blurry vision, nausea vomiting, and confusion (8). In the present case, the patient referred because of upper GIS bleeding as a result of severe retching and vomiting after 16 hours.

There is severe retching, cough, straining, or vomiting before bleeding in Mallory-Weiss syndrome (1). The present case also referred to severe retching and vomiting history before the bleeding in line with the literature. Excessive alcohol intake was detected in 40% to 80% of the patients diagnosed with Mallory-Weiss syndrome (4). Our case also developed vomiting after alcohol intake.

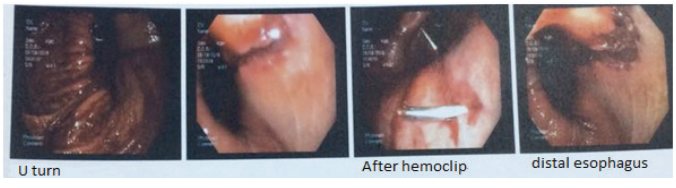

Figure 1. Urgent endoscopy image

The bleeding usually stops spontaneously in Mallory-Weiss syndrome, and the conservative approach is sufficient for most cases. When endoscopic findings demonstrate active bleeding, different endoscopic techniques (hemoclips, band-ligation, epinephrine injection) may be used (9). Since the active bleeding persisted in our case during endoscopy, hemoclips was performed for bleeding control as parallel to the literature.

Early diagnosis and treatment have vital importance in methanol intoxication. Patient history, visual disorder, and high anion gap metabolic acidosis are indicative of diagnosis (10). Blood methanol level provides the final diagnosis (11). However, analysis of the methanol level in the blood may not be performed in every laboratory; therefore, urgent treatment should be started in case of metabolic acidosis. Since we also could not detect the level of methanol in the blood, we repeated the history taking because of laboratory analyses indicating toxic alcohol intake as well as clinical suspicion. We started urgent treatment due to the diagnosis of methanol intoxication.

The general treatment approach for methanol intoxication includes gastric irrigation, ethanol infusion, hemodialysis, folate, and thiamine administration (6). Gastric irrigation is performed for the patients referring within the first hour; we did not implement gastric irrigation because our case referred 16 hours later. Oral, IV , or nasogastric administration of ethanol is used as an initial treatment for methanol intoxication. We performed IV ethanol treatment according to the literature. Fomepizole is a competitive inhibitor of alcohol dehydrogenase and prevents transformation into formic acid (12). We could not administer fomepizole, as this agent was not available in our hospital. If there are visual symptoms in methanol intoxication and CNS dysfunction findings as well as methanol level over 25 mg/dL and severe metabolic acidosis, dialysis should be performed (7). Hemodialysis was performed due to high anion gap metabolic acidosis.

Conclusion

Detailed patient history is vital for the patients presenting bloody vomiting to determine the precipitating cause of GIS bleeding. Mallory-Weiss syndrome may develop in upper GIS bleeding cases triggered by vomiting and have mortal causes. Therefore, a detailed patient history, as well as rapid diagnosis and treatment by emergency clinicians, have vital importance.

Ethics

Informed Consent: Verbal informed consent was obtained from the patient who participated in this study.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: S.D., D.C, Concept: B.D., U.M.K., Design: A.E., M.D., Data Collection or Processing: R.Y., B.C., D.C., Analysis or Interpretation: S.D., U.M.K., B.C., Literature Search: D.C., B.B., M.D., Writing: U.M.K., D.C., S.D.

Conflict of Interest: No conflict of interest was declared by the authors.

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Pseudopneumothorax: Emphysema Case Mimicking Pneumothorax

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Abstract

Bedside lung ultrasound (LUS) is generally emergency rooms for the patients suspected to have lung pathology. LUS is especially important for quick diagnosis and fast treatment, especially in unstable patients. Pneumothorax is the condition of air entering between pleural plaques and lung being separated from the thoracic wall. Typically, there is a low amount of lubricating fluid between visceral pleura covering the lung and parietal pleura covering the inner face of the thoracic wall. Emphysema is the abnormal widening of air sacs distal to the terminal bronchioles with the destruction of alveolar walls without fibrosis, and it is one of the obstructive lung diseases. Cases, where emphysema is confused with pneumothorax, were also defined rarely in the literature. We wanted to create awareness on the place of ultrasound on pneumothorax diagnosis by sharing the emphysema case imitating pneumothorax in LUS seen rather rare in literature.

Keywords: Lung ultrasound, pneumothorax, emphysema, lung air cysts

Introduction

Pneumothorax is the condition of air entering between pleural membranes that causes lung being separated from the thoracic wall. Typically, there is a low amount of lubricating fluid between visceral pleura covering the lung and parietal pleura covering the inner face of the thoracic wall. Pneumothorax is examined under three titles as primary, secondary, and tension pneumothorax. Treatment is determined according to the amount of air and pneumothorax type. Evaluation of standing inspiration and expiration chest X-ray is primarily suggested in spontaneous pneumothorax diagnosis. The use of computed tomography (CT) is suggested in cases with uncertain diagnosis or complex cases (1).

Emphysema is the abnormal widening of air sacs distal to the terminal bronchioles with the destruction of alveolar walls without fibrosis, and it is one of the obstructive lung diseases. It has three types; centrilobular, panlobular, and paraseptal (2).

Bedside lung ultrasound (LUS) is generally performed in emergency rooms (ER) to the patients suspected to have lung pathology. LUS is especially important for quick diagnosis and fast treatment, particularly in unstable patients. LUS may provide to make a diagnosis without ionizing radiation exposure in diseases such as pleural effusion, interstitial syndromes, pneumothorax and pneumonia, and ultrasound is now seen as a way to provide speed in all kinds of time consuming works including difficult peripheric vascular access interventions to decrease complication rate in ER (3,4).

Cases, where emphysema is confused with pneumothorax, were also reported rarely in the literature (5). We aimed to draw attention to the application of ultrasound for the detection of pneumothorax by sharing the emphysema case mimicking pneumothorax in LUS that seen rather rare in literature.

Case Report

Fifty years old male patient referred to ER with the complaint of hemoptysis. Vital findings were as follows at referral: Non-invasive blood pressure: 107/69 mmHg, heart rate: 60/min, oxygen saturation (SaO_2): 96%, body temperature: 37.1 °C.

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The patient had asthma and was not using any medicine other than daily inhaled budesonide, formoterol fumarate, and tiotropium bromide. The patient had diagnosed with tuberculosis (TB) five years ago and had an inpatient treatment period in the chest clinic. He had continued anti-TB treatment for 2.5 months but had stopped taking medicine without a doctor visit.

The patient had 200-300 cc hemoptysis at 01.30 am and was brought to the ER in an ambulance at 02.00 am. He did not have any hemoptysis in the follow-ups, until the morning. In the physical examination of the patient who has a cachectic appearance, no pathological findings were detected apart from coarse rale in the left lung upper lobe.

No significant anomalies were detected in common blood count, biochemistry, coagulation profile, and D- dimer values studied. No anomalies were detected apart from hypoxia in arterial blood gas analysis (pH: 7.422, pCO_2: 38.8 mmHg, pO_2: 58.6 mmHg). No urgent pathological changes were detected in electrocardiography.

Radiological evaluation; the diaphragm was straightened on the left and located above, spread loss of density in the right lung, reticular density increase in the right lung, and reticulonodular density increase in the left lung and spread linear atelectatic bands were observed in both lungs according to the chest X-ray taken. Atelectatic areas were observed in the left apex of the lung, and blunting was observed in left costophrenic sinus (Figure 1A).

Eight zones were evaluated at the bedside LUS. No significant pathologies were detected on the right. On the left side, no pleural movements were detected in zones 1, 2, 3, 4, and a stratosphere sign was observed. Also, a standstill B line was detected in zone 1 on the left side (Figure 1B).

Despite the existence of LUS pneumothorax findings, a pneumothorax line was not detected in chest X-ray, so thorax CT of the patient was taken considering that a small pneumothorax might be present. However, pneumothorax was not observed in thorax CT too.

In thorax CT; fibrotic and cystic changes in the upper lobe in both lungs, on the right lung, paraseptal emphysema areas, more commonly in upper lobe, 6 mm calcified pulmonary nodule in the lower lobe of right lung and calcification in the diaphragmal face, fibrocystic changes in upper lobe apical segment (fibrosis secondary to previous TB?) and on the left lung, bronchiectases, infiltrative consolidation areas in ground glass density, spread mostly in subpleural area and thin-walled cystic lesions were reported. Linear atelectasis was reported in both lungs, shown in Figure 2.

As a result, pneumothorax was not found in our patient who had a barcode/stratosphere sign, which is accepted specific for pneumothorax. The primary diagnosis was found to be lung emphysema reported together with changes secondary to TB. Finally, the patient consulted with pulmonology and hospitalized to perform a bronchoscopy.

Discussion

Bedside ultrasonography is successfully used as a fast diagnosis tool for some traumatic or non-traumatic diseases in ER for more than ten years (3). Its success rate is high, especially in unstable patients or patients with position limits for other imaging methods. In addition to generally being traumatic,

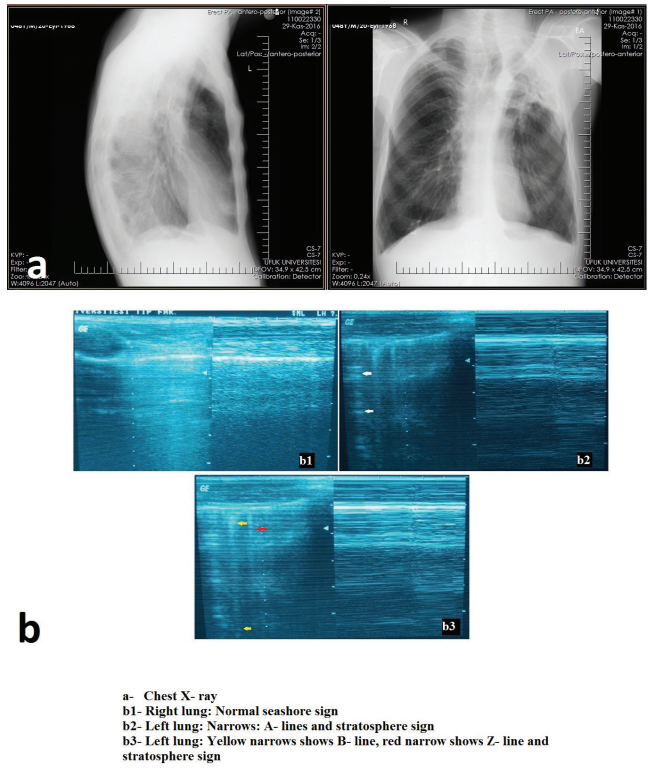

Figure 1. Images of chest X-ray and lung ultrasonography

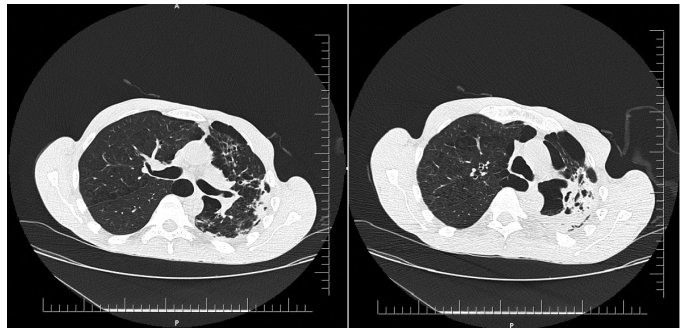

Figure 2. Images of thorax computed tomography, emphysema and air cystic structures

pneumothorax can also be spontaneous. Traditionally, when the pneumothorax is suspected, a chest X-ray is evaluated, but its success rate was reported 36-48% percent in different studies (6). The Eastern Association for the Surgery and Trauma renewed their guide in 2011 and gave level 2 recommendation to ultrasound in diagnosis of pneumothorax (7) Chest X-ray and LUS were compared in a retrospective review and ultrasound was found to detect pneumothorax with 93.9% sensitivity and its negative predictive value was found 99.9% (8). LUS and multidetector CT were compared in another retrospective study, and sensitivity of ultrasound in the diagnosis of pneumothorax was found 77%, and specificity was found 99.9%. Even though ultrasound was not found as successful as CT, there are restrictions in CT use for unstable patients (9). Additionally, in a pneumothorax case written by Unluer and Karagoz (10) a fast diagnosis was provided by showing lung point with bedside LUS in a 17 year old male patient referring to the ER with pain in left shoulder and without any story of trauma and the patient was discharged six hours later after being treated with needle aspiration. The International Liaison Committee on LUS published some proof-based suggestions for LUS in 2011 (11). In a lung with decent aeration, pleural line, lung sliding, and A-lines should be seen 2D and seashore sign should be seen in M mode so different lung pathologies can be considered ultrasonographically when these are missing (12). LUS in critically ill patients includes 10 findings such as bat sign (pleural line), lung sliding (seashore sign); A lines (horizontal artifact); quad sign showing pleural effusion (quadrant) and sinusoid sign, fractal and tissue-like sign showing consolidation in lung, B lines and lung rockets showing interstitial syndromes; stratosphere sign without observance of lung sliding causing us to consider pneumothorax and 2 other signs in addition to lung point showing pneumothorax; such as lung pulse distinguishing atelectasis from pneumonia and dynamic air bronchogram (3). Lack of or decrease in lung sliding can also be seen in complete atelectasis, massive fibrosis, abdominal compartment syndrome, severe acute asthma attack, apnea, and cardiorespiratory arrest cases (13). It should also be kept in mind that low-frequency (2.5 Hz) probes would not be satisfactory for detecting lung sliding movement (3).

In LUS of pneumothorax, lung sliding is not observed, A-lines are observed ahead hyperechoic parietal pleural-air border and form characteristic “stratosphere finding, barcode finding” appearance in M mode. The observance of the B line excludes pneumothorax because this line originates only from the visceral pleura-lung border. However, it should be kept in mind that Z-lines are changes that can imitate B-lines. Again the lung point, which indicates the location where the lung is separated from the chest wall, is where stratosphere finding and seashore sign are seen together in M mode, supports pneumothorax. As a result, four characteristic sonographic findings of pneumothorax are lack of lung sliding, B-lines and lung pulse, and the presence of lung point (11,12,14).

In the case report by Kumar et al. (5), a 26-days old infant referred to ER due to respiratory distress, and pneumothorax was considered according to the chest X-ray taken, but there was no recovery, so thorax CT was taken and finally, congenital lobar emphysema was detected (5). Emphysematous areas may imitate pneumothorax in LUS in chronic obstructive pulmonary disease (COPD) patients, according to Slater et al. (15) Thus, ultrasound may be used to exclude pneumothorax in COPD patients, but additional imaging methods are required for pneumothorax diagnosis (15).

A stratosphere sign of pneumothorax was observed in our case, but pneumothorax was not detected in the thorax CT taken.

Conclusion

As a result, because of the advantages of better portability, quickness, real-time imaging, cost-saving, and no exposure to ionizing radiation (especially in children and pregnant women), ultrasound is such a useful method with high applicability in critically ill patients suspected to have lung pathology. It saves time for diagnosis and provides immediate therapeutic approaches in ER, but in some complex cases, we recommend that the diagnosis should be confirmed with more advanced imaging techniques in case of clinical suspicion.

Ethics

Informed Consent: The authors declared that the research was conducted according to the principles of the World Medical Association Declaration of Helsinki “Ethical Principles for Medical Research Involving Human Subjects”, (amended in October 2013). Written informed consent was obtained from patients who participated in this case.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Concept: L.Ö.S., M.K.A., T.E., E.E.Ü., Design: L.Ö.S., M.K.A., T.E., E.E.Ü., Data Collection or Processing: L.Ö.S., T.E., Analysis or Interpretation: L.Ö.S., M.K.A., T.E., E.E.Ü., Literature Search: L.Ö.S., T.E., Writing: L.Ö.S., M.K.A., T.E., E.E.Ü.

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