

Defensive Medicine Practices Among Ophthalmologists in Turkey

Türkiye'deki Oftalmologlar Arasında Defansif Tıp Uygulamaları

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ABSTRACT Objective: To investigate the prevalence of defensive medicine among ophthalmologists in Turkey and how malpractice cases affect ophthalmologists. **Material and Methods:** Surveys about defensive medicine were sent to the e-mail addresses of 247 ophthalmologists registered with the Turkish Ophthalmological Association between July 2019 and November 2019. In addition, direct interviews were conducted with the doctors between the same dates. **Results:** A total of 194 (78.5%) out of 247 ophthalmologists completed the survey. The survey results showed that, while most of the doctors had previously heard of defensive medicine, they did not have detailed knowledge about this concept and 66.5% of the ophthalmologists who responded want additional consultation for defensive purposes and 57.7% would like additional laboratory tests. In addition, 67.5% stated that they avoided cases that were difficult to diagnose and treat, while 68.6% stated that they avoided high-risk surgeries. Although only 6.2% of respondents had faced malpractice lawsuits, 78.7% of ophthalmologists stated that these cases affected their clinical practice. **Conclusion:** To the best of our knowledge, this is the first study investigating defensive medicine among ophthalmologists. Our results showed that defensive medicine is common in ophthalmology. In addition, malpractice cases increase defensive medicine among ophthalmologists and negatively affect their professional lives.

ÖZET Amaç: Türkiye'deki oftalmologlar arasında defansif tıp uygulamalarının yaygınlığını ve malpraktis davalarının, oftalmologları nasıl etkilediğinin araştırılması. **Gereç ve Yöntemler:** Temmuz 2019 ve Kasım 2019 tarihleri arasında defansif tıp uygulamaları ile ilgili hazırlanmış anketler, 247 oftalmologun Türk Oftalmoloji Derneğine bildirdikleri elektronik posta adreslerine gönderildi. Ayrıca aynı tarihler arasında doktorlarla doğrudan görüşmeler yapılarak, anketlerin cevaplanması istendi. **Bulgular:** Anketin ulaştırıldığı 247 oftalmologdan 194 (%78,5)'ü anketi tamamladı. Anket sonuçları doktorların büyük bir kısmının defansif tıp kavramını daha önce duyduğunu fakat bu kavram hakkında detaylı bilgi sahibi olmadıklarını gösterdi. Anketi cevaplayan oftalmologların %66,5'i defansif amaçlarla ek konsültasyon istediklerini, %57,7'si ise ek laboratuvar tetkikleri istediklerini belirtti. Ayrıca %67,5'i tanı ve tedavisi güç vakalardan, %68,6'sı ise yüksek riskli cerrahilerden kaçındıklarını belirtti. Anketi cevaplayanların yalnızca %6,2'si malpraktis nedeniyle dava edilmiş olmasına karşın oftalmologların %78,7'si, bu davaların klinik pratiklerini etkilediğini belirtti. **Sonuç:** Bildiğimiz kadarı ile bu çalışma, oftalmologlar arasında defansif tıbbın araştırıldığı literatürdeki ilk çalışmadır. Sonuçlarımız, oftalmoloji alanında da defansif tıbbın yaygın olduğunu göstermiştir. Ayrıca malpraktis davaları, oftalmologlar arasında defansif tıbbı yaygınlaştırmakta ve meslek hayatlarını olumsuz etkilemektedir.

Keywords: Defensive medicine; malpractice; insurance, liability

Anahtar Kelimeler: Defansif tıp; malpraktis; sigorta, yükümlülük

In the past, most patients did not question their doctors' advice. Currently, however, patients are more likely to ask questions about the treatment options offered to them and can sue the doctor if they do not get the results they expect from treatment.^{1,2} This situation changed the way doctors approach patients, and the phenomenon of defensive medicine emerged.

Defensive medicine is defined as the practice of physicians requiring extra imaging and laboratory tests, recommending hospitalizations, and avoiding risky patients in order to avoid medical malpractice cases. While additional diagnostic and treatment methods are considered positive defensive medicine, avoiding high-risk patients and surgeries constitutes the concept of negative defensive medicine.^{3,4}

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Today, malpractice cases are seen worldwide, and this has led to a substantial increase in defensive medicine. Additional unnecessary tests and treatments lead to high costs and adversely affect the quality of treatment.⁵⁻⁸ With increasing malpractice cases and defensive medicine practices, it is becoming increasingly difficult to differentiate between the factors affecting the professional responsibilities of doctors and other factors, such as those relevant to meeting patient expectations and avoiding conflict.⁹

Although there are studies about defensive medicine in many specialities of the literature, to the best of our knowledge, there has not yet been a study on defensive medicine in ophthalmology. In the current study, we attempt to reveal the effects of defensive medicine in ophthalmology for the first time.

MATERIAL AND METHODS

This cross-sectional study adhered to the tenets of the Declaration of Helsinki and received approval from the ethics committee of Şişli Hamidiye Etfal Training and Research Hospital (793/18.04.2017). Standardized surveys (revised to be specific for the field of ophthalmology) were sent to the email addresses of 247 ophthalmologists registered with the Turkish Ophthalmological Association whose all contact information is available, between July 2019 and November 2019.¹⁰ In some cases, direct interviews (instead of surveys) were conducted with doctors between the same dates. Demographic information (age, gender, clinical status, and type of hospital) was requested. To prevent bias, the names of the ophthalmologists are not recorded. In order to investigate the ophthalmologists' awareness of the concepts of defensive medicine and malpractice, a four-question survey with yes and no options was applied. To investigate positive and negative defensive medicine practices of ophthalmologists, two different surveys with five or six questions were used. A five-question survey was used to investigate the effects of malpractice cases on ophthalmologists. For these three surveys, respondents were asked to select one of five answers for each question (strongly agree, agree, neutral, disagree, strongly disagree).

RESULTS

A total of 194 (78.5%) out of 247 ophthalmologists who were sent the survey completed the survey. The

TABLE 1: Demographic characteristics of survey respondents.

		n	%
Gender	Male	86	44.3
	Female	108	55.7
Age	Male	42.4	N/A
	Female	44.6	N/A
Clinical status	1-10 years in practice	68	35
	11-20 years in practice	64	33
	21-30 years in practice	62	32
Hospital type	Public hospital	102	52.6
	University hospital	31	16
	Private hospital	61	31.4

TABLE 2: Survey results: Investigating awareness of defensive medicine and malpractice cases.

	Yes (%)	No (%)
Have you ever heard the term defensive medicine?	95.4	4.6
Do you have enough knowledge about defensive medicine?	56.7	43.3
Did malpractice cases affect your medical practices?	78.7	21.3
Have you ever been investigated for malpractice during your life of profession?	6.2	93.8

demographic characteristics of the ophthalmologists participating to the study are given in [Table 1](#).

The results revealed that, while most of the doctors had previously heard of defensive medicine, they did not have detailed knowledge about this concept. In addition, although very few ophthalmologists have been sued for malpractice, a high percentage of them reported being negatively affected by these cases ([Table 2](#)).

The results of the survey conducted to investigate positive defensive medicine practices revealed that most of the doctors applied positive defensive medicine (they wanted extra laboratory tests, imaging, and consultations, and tried to keep a detailed record; [Table 3](#)).

In completing the survey conducted to investigate negative defensive medicine practices, doctors reported that they avoided patients with the potential to complain. They also reported avoiding surgeries with a high risk of complications, especially, and that they tended to prefer non-invasive treatments ([Table 4](#)).

TABLE 3: Survey results: Investigating positive defensive medicine.

	++	+	0	-	--
I recommend hospitalization to patients who do not need hospitalization for defensive purposes	16.4%	18.6%	12.9%	23.1%	29%
I order additional laboratory tests for defensive purposes	22.7%	35%	21.7%	11.9%	8.7%
I recommend additional medical therapy for defensive purposes	8.8%	11.9%	18.6%	16.5%	45.2%
I obtain initial consultations for defensive purposes	32.5%	34%	9.8%	12.4%	11.3%
I keep a more detailed record for defensive purposes	56.7%	20.1%	12.4%	8.7%	2.1%
I give detailed information to patients and their relatives for defensive purposes	57.8%	21.7%	11.6%	6.7%	2.2%

TABLE 4: Survey results: Investigating negative defensive medicine.

	++	+	0	-	--
I refer patients that I would not normally refer for defensive purposes	29.4%	29.4%	16.5%	11.9%	12.8%
I avoid patients and relatives who are likely to complain for defensive purposes	23.2%	33%	21.2%	13.9%	8.7%
I avoid cases that are difficult to diagnose and treat for defensive purposes	50%	17.5%	12.4%	8.8%	11.3%
I avoid performing surgeries with a high risk of complications for defensive purposes	50%	18.6%	12.4%	9.8%	9.2%
I prefer non-invasive methods instead of invasive methods for defensive purposes	32.5%	27.8%	16.5%	12.4%	10.8%

TABLE 5: Survey results: Investigating the effects of malpractice cases on ophthalmologists.

	++	+	0	-	--
Do you think you will be sued for malpractice in the next ten years?	29.4%	19.6%	25.8%	14.4%	10.8%
Do you worried about malpractice issues in the press?	53.6%	26.8%	12.4%	5.1%	2.1%
If the investigator will be expert in malpractice in investigations, will it have an impact on defensive medicine practices?	60.8%	22.1%	10.3%	4.1%	2.7%
Would the practice of defensive medicine diminish if there was a special law in line with the conditions of the health profession?	56.7%	21.7%	7.7%	7.2%	6.7%

Doctors responding to the survey on how malpractice cases affect doctors revealed that these cases seriously worry doctors and the respondents thought that the investigator should be an expert in the field of malpractice and that special laws should be enacted for malpractice cases (Table 5).

DISCUSSION

Our results demonstrated for the first time that defensive medicine was common among ophthalmologists. The vast majority of the ophthalmologists who participated in our study stated that malpractice cases affected their clinical practice and that they avoided patients with difficult diagnoses and treatments. In particular, they avoided performing surgeries with a high risk of complications. It was also shown that the rate of requesting extra laboratory tests and imaging for defensive purposes is high and that doctors avoid patients they believe might complain.

Defensive medicine is one of the biggest problems in the health sector today. Previous studies have shown that it has a negative effect on the treatment of patients and on doctors.^{8,11} In addition, extra tests and treatments increase costs substantially. In a study conducted in the United States, it was found that the cost of investigations and imaging required for defensive purposes in 2008 was \$55.6 billion, corresponding to 2.4% of the country’s total healthcare expenditure.¹² In addition, the increasing number of malpractice cases negatively affects the working life of doctors as demonstrated in the results of our study. This phenomenon is even more apparent in surgical specialities, as five times more malpractice cases are opened against doctors in surgical specialities than in non-surgical specialities.¹³

In studies performed in many countries throughout the world, defensive medicine has been shown to be a serious problem. In a study conducted in Eng-

land, it was revealed that 59.3% of the doctors requested unnecessary tests, 23% gave treatment even though it was not necessary, and 20.6% avoided performing surgeries with a high risk of complications.¹⁴ Studies in the United States and Japan showed that over 75% of doctors practice defensive medicine.^{9,15,16} In a study conducted with anaesthesiologists in Turkey, it was shown that 73% of the doctors wanted additional unnecessary tests, and 75% of them referred patients for defensive purposes.¹⁷

Malpractice cases and increasing punishments have become worrying in our country.¹⁸ The Turkish Criminal Law, which came into effect in 2005, contains severe criminal sanctions against doctors. If a doctor refrains from treating a patient for defensive purposes, they are charged with deliberate injuries and deaths. If negative consequences arise as a result of a treatment, they are tried with crimes of negligence.¹⁹ The increase in malpractice cases also affects the speciality selection of doctors in our country. In Turkey, the speciality is selected from the person's choices according to the score obtained in the Specialization Exam in Medicine, which is taken after medical school is completed. Due to the increasing number of malpractice cases, doctors who scored high in the examination are increasingly less likely to prefer surgical and life-threatening specialities.²⁰

In previous studies throughout the world, defensive medicine in specialities with more emergency pathologies and life-threatening surgeries has been examined. In these studies, it has been revealed that defensive practices are quite common in those fields. For example, in obstetrics, doctors tend to prefer caesarean rather than vaginal delivery.^{21,22} Similarly, a study on neurosurgeons in the United States revealed that doctors refrained from taking risky cases and asked for additional examinations for defensive purposes.²³ In a study conducted in Japan, 98% of gastroenterologists applied defensive medicine, and in a study conducted in Italy, 94% of gastroenterologists and 83% of surgeons and anaesthesiologists applied defensive medicine.^{15,24,25} In a study investigating defensive medicine practices in orthopaedists, it was shown that almost all orthopaedists practice defensive medicine.²⁶ In another study, it was revealed that 70% of emergency medicine physicians demanded

extra examinations for defensive purposes and that 43% of general surgeons avoided high-risk surgeries.⁹ Such practices may be explained by the results of studies like those of Jena et al., which stated that 19% of the doctors working in the fields of vascular, thoracic, and cardiac surgery faced malpractice cases.¹³ In their study, Vimercati et al. reported that defensive medicine practices were seen in doctors of all specialities, and that differences among specialities occurred only due to the expected legal pressure in a particular speciality.²⁷

In the current study, the survey we conducted to investigate the awareness of defensive medicine and malpractice cases revealed that almost all of the ophthalmologists had heard about the concept of defensive medicine, but 43.3% did not have detailed knowledge of this practice. In addition, although only a small number of doctors had previously faced malpractice cases, most of the doctors said that these cases affect their clinical practices.

In the survey we conducted to investigate the positive defensive medicine practices of doctors, it was revealed that more than half of the doctors requested extra laboratory tests and imaging for defensive purposes. Moreover, 66.5% stated that they wanted extra consultation for defensive purposes. However, only a few of them reported recommending additional medical treatment and hospitalization. These results suggest that the doctors act to prevent the possibility of being accused of negligence if a case is filed against them and that they act more confidently after they are sure of the diagnosis.

The results of the survey in which we investigated doctors' negative defensive medicine practices and the effects of malpractice cases on doctors showed that almost half of the doctors referred patients for defensive purposes and that more than half of the doctors avoided patients with the potential to complain, patients with difficult-to-diagnose cases, and patients who required risky surgeries. In addition, almost half of the doctors were worried about facing a lawsuit, 80.4% were negatively affected by reports in the news media, and 74.7% took out malpractice insurance. The results of the survey also showed that

almost all doctors think that special laws and investigators should be available for malpractice cases.

In a profession with a high risk by nature, the fact that doctors face a constant risk of litigation makes it impossible for them to work in a healthy way. None of the negative results that occur are intentional. Vaughan stated that giving high punishments is ineffective in preventing people's accidental mistakes.²⁸ The punitive approach encourages defensive behaviour and prevents doctors from taking responsibility, facing their mistakes, and learning lessons from the experience if necessary. This situation decreases patient safety instead of increasing it.¹⁰ Creating an arena in which doctors will not be punished for unintentional mistakes will both open their minds to criticism and contribute to their development. Penalties should be imposed not for negligence and wrong choices, but for gross negligence, malicious rule violations, and irreversible destructive consequences. In a properly constructed system, the doctor himself can distinguish between acceptable and unacceptable mistakes.²⁹⁻³¹

However, removing doctors from the malpractice system would eliminate defensive behaviours that have been clearly demonstrated to benefit patients. On the other hand, since this would prevent unnecessary consultations, it would enable the doctor to adopt the patient and improve the doctor-patient relationship. In addition, extra costs caused by defensive medicine will be prevented. Moreover, professional insurance costs, which have been shown not to reduce defensive medicine, will decrease.^{32,33}

Our study also has some limitations. In our study, although the doctors were asked not to write their names on the forms, the fact that demographic information was taken may have caused a risk of bias in the answers. Moreover, the fact that the answers were not evaluated separately according to the age of

the doctors, the time spent in the profession, and the hospital they work is another limited aspect of our study. Furthermore, since we conducted a cross-sectional study, any changes in the opinions of doctors were not revealed in our study.

CONCLUSION

In conclusion, although there have been studies on defensive medicine published in other fields, to our knowledge, this is the first defensive medicine study in ophthalmology. We believe that our study shows significant results, as it revealed that doctors practice defensive medicine in ophthalmology, a speciality in which acute pathologies are rare and patients do not have a life-threatening risk.

Source of Finance

During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that provides or produces medical instruments and materials which may negatively affect the evaluation process of this study.

Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: Delil Özcan, Abdullah Alparslan Alkan; **Design:** Delil Özcan, Abdullah Alparslan Alkan; **Control/Supervision:** Delil Özcan, Abdullah Alparslan Alkan; **Data Collection and/or Processing:** Delil Özcan, Abdullah Alparslan Alkan; **Analysis and/or Interpretation:** Delil Özcan, Abdullah Alparslan Alkan; **Literature Review:** Delil Özcan, Abdullah Alparslan Alkan; **Writing the Article:** Delil Özcan, Abdullah Alparslan Alkan; **Critical Review:** Delil Özcan, Abdullah Alparslan Alkan; **References and Fundings:** Delil Özcan.

REFERENCES

- Thorpe KE. The medical malpractice 'crisis': recent trends and the impact of state tort reforms. *Health Aff (Millwood)*. 2004;Suppl Web Exclusives:W4-20-30. [Crossref] [PubMed]
- Nguyen Thi PL, Briçon S, Empereur F, Guillemin F. Factors determining inpatient satisfaction with care. *Soc Sci Med*. 2002;54(4):493-504. [Crossref] [PubMed]
- U.S. Congress, Office of Technology Assessment. *Defensive Medicine and Medical Malpractice*. OTA-H-602. Washington, DC: U.S. Government Printing Office; 1994. [Link]
- Tancredi LR, Barondess JA. The problem of defensive medicine. *Science*. 1978; 200(4344):879-82. [Crossref] [PubMed]
- Tuers DM. Defensive medicine in the emergency department: increasing health care costs without increasing quality? *Nurs Adm Q*. 2013;37(2):160-4. [Crossref] [PubMed]
- Bishop TF, Federman AD, Keyhani S. Physicians' views on defensive medicine: a national survey. *Arch Intern Med*. 2010;170(12):1081-3. [Crossref] [PubMed]
- Mello MM, Chandra A, Gawande AA, Studdert DM. National costs of the medical liability system. *Health Aff (Millwood)*. 2010;29(9):1569-77. [Crossref] [PubMed] [PMC]
- Ridic G, Howard T, Ridic O. Medical malpractice in connecticut: defensive medicine, real problem or a red herring - example of assessment of quality outcomes variables. *Acta Inform Med*. 2012;20(1):32-9. [Crossref] [PubMed] [PMC]
- Studdert DM, Mello MM, Sage WM, DesRoches CM, Peugh J, Zapert K, et al. Defensive medicine among high-risk specialist physicians in a volatile malpractice environment. *JAMA*. 2005;293(21):2609-17. [Crossref] [PubMed]
- Catino M. Why do doctors practice defensive medicine? The side-effects of medical litigation. *Safety Science Monitor*. 2011;1(15). [Link]
- Studdert DM, Mello MM, Brennan TA. Medical malpractice. *N Engl J Med*. 2004;350(3):283-92. [Crossref] [PubMed]
- Dove JT, Brush JE Jr, Chazal RA, Oetgen WJ. Medical professional liability and health care system reform. *J Am Coll Cardiol*. 2010; 55(25):2801-3. [Crossref] [PubMed]
- Jena AB, Seabury S, Lakdawalla D, Chandra A. Malpractice risk according to physician specialty. *N Engl J Med*. 2011;365(7):629-36. [Crossref] [PubMed] [PMC]
- Ortashi O, Virdee J, Hassan R, Mutrynowski T, Abu-Zidan F. The practice of defensive medicine among hospital doctors in the United Kingdom. *BMC Med Ethics*. 2013;14:42. [Crossref] [PubMed] [PMC]
- Hiyama T, Yoshihara M, Tanaka S, Urabe Y, Ikegami Y, Fukuhara T, et al. Defensive medicine practices among gastroenterologists in Japan. *World J Gastroenterol*. 2006;12(47):7671-5. [Crossref] [PubMed] [PMC]
- Rodriguez RM, Anglin D, Hankin A, Hayden SR, Phelps M, McCollough L, et al. A longitudinal study of emergency medicine residents' malpractice fear and defensive medicine. *Acad Emerg Med*. 2007;14(6):569-73. [Crossref] [PubMed]
- Akinci SB, Sarıcaoğlu F, Erden İA, Köseoğlu A, Aypar Ü. [The investigation of defensive medicine applications in anesthesiologists]. *Anestezî Derg*. 2013;21(1):151-6. [Link]
- Yılmaz A, Demiral G, Şahin G, Yener O, Kocataş A, Bölük S. The Impact of Turkish Penal Code (TPC) which entered into force in 2005 on surgeons. *J For Med*. 2013;27(3):158-72. [Crossref]
- Kanunu TC. *Türk Ceza Kanunu*. Retrieved December. 2004;13:2012.
- Kaşap H, Akar T, Demirel B, Dursun AZ, Sarı S, Özkök A, et al. [The change of preference priorities on examination for specialty in medicine by years of high risky medical branches in medical malpractice]. *The Bulletin of Legal Medicine*. 2015;20(1):34-7. [Crossref]
- Zwecker P, Azoulay L, Abenheim HA. Effect of fear of litigation on obstetric care: a nationwide analysis on obstetric practice. *Am J Perinatol*. 2011;28(4):277-84. [Crossref] [PubMed]
- Hamilton BE, Martin JA, Ventura SJ. Births: preliminary data for 2009. *Natl Vital Stat Rep*. 2010;59(3):1-19. [PubMed]
- Nahed BV, Babu MA, Smith TR, Heary RF. Malpractice liability and defensive medicine: a national survey of neurosurgeons. *PLoS One*. 2012;7(6):e39237. [Crossref] [PubMed] [PMC]
- Elli L, Tenca A, Soncini M, Spinzi G, Buscarini E, Conte D. Defensive medicine practices among gastroenterologists in Lombardy: between lawsuits and the economic crisis. *Dig Liver Dis*. 2013;45(6):469-73. [Crossref] [PubMed]
- Catino M, Celotti S. The problem of defensive medicine: two Italian surveys. *Stud Health Technol Inform*. 2009;148:206-21. [PubMed]
- Sethi MK, Obremsky WT, Natividad H, Mir HR, Jahangir AA. Incidence and costs of defensive medicine among orthopedic surgeons in the United States: a national survey study. *Am J Orthop (Belle Mead NJ)*. 2012;41(2):69-73. [PubMed]
- Vimercati A, Greco P, Loizzi V, Loverro G, Selvaggi L. ["Defensive medicine" in the choice of cesarean section]. *Acta Biomed Ateneo Parmense*. 2000;71 Suppl 1:717-21. [PubMed]
- Vaughan D. *The Challenger Launch Decision: Risky Technology, Culture, and Deviance at NASA*. Chicago: University of Chicago Press; 1996. ISBN: 9780226346960. [Crossref]
- Reason JT. *Managing the Risks of Organizational Accidents*. London; New York: Routledge; 2016. ISBN: 9781315543543. [Crossref]
- Ferguson J, Fakelmann R. The culture factor. *Front Health Serv Manage*. 2005;22(1):33-40. [Crossref] [PubMed]
- Dekker S. *Just Culture: Balancing Safety and Accountability*. 2nd ed. Boca Raton: CRC Press; 2016. [Crossref]
- Adwok J, Kearns EH. Defensive medicine: effect on costs, quality and access to health-care. *Journal of Biology, Agriculture and Healthcare*. 2013;3(6):29-35. [Link]
- Antoci A, Maccioni AF, Galeotti M, Russu P. Defensive medicine, liability insurance and malpractice litigation in an evolutionary model. *Nonlinear Analysis: Real World Applications*. 2019;47:414-35. [Crossref]