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RESEARCH ARTICLE

Ethical Concerns in Dermatology and Cosmetic Applications

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Abstract

Our aim in this article is to consider ethical concerns and sensitivities in Dermatology and Cosmetic applications. It is appropriate for dermatologists to make cosmetic applications and use artificial intelligence aid as experts who know the structure and diseases of the skin best. The practice of cosmetology by physicians other than dermatologists creates ethical problems.

Women are especially more interested in dermatology. Body dysmorphic disorders are more common in women. When dermatologists evaluate the cosmetic dermatology patient and create a treatment plan, if there are unrealistic expectations, the patient should be guided correctly by considering the patient's wishes. Social media applications, which have attracted attention in recent years, have caused an increase in body dysmorphic disorders in individuals.

Cosmetology is a division that can never be separated from dermatology. Patients frequently apply to cosmetic dermatology because of hyperpigmentation problems, aging problems, hair problems, toxin applications, dermal filler procedures, chemical peels, and mesotherapy, and ablative laser procedures. Burns resulting from laser epilation applications performed in aesthetic centers, complications such as tissue necrosis caused by dermal filler procedures performed by non-physicians, cosmetic problems, soft tissue infections, and allergic reactions resulting from applications such as mesotherapy and platelet-rich plasma are diseases frequently seen in dermatology outpatient clinics.

Another important issue is the materials used in platelet-rich plasma, mesotherapy, toxin application, and dermal filler applications must be in the Class 3 Medical device category. Patients who apply to clinics for treatment should be made aware of this issue and patients should be protected from the complications that these medications may cause. Physicians should not use products that do not have class 3 certificates in cosmetic dermatology to keep the cost of the product low, especially when choosing materials.

In medicine, there is always an aesthetic concern beyond technical or even scientific concerns. We think that it is necessary to express and elaborate on the concerns arising from the ethical issues that are experienced or may be experienced in dermatology practices. Physicians always try to take the patient's psychological and pathological problems into consideration. However, ethical concerns should not be forgotten when treating the field of aesthetics.

Keywords: Dermatology, cosmetics, artificial intelligence, ethics, medical ethics

1. INTRODUCTION

Artificial Intelligence (AI) is the ability to imitate human cognitive functions such as learning and problem-solving using machine software and it was first used at the Dartmouth conference in 1956. Although the concept of intelligence has very different definitions, there are some points in common.[1] Generally intelligence means abilities such as learning, reaching new results from what has been learned, understanding, reasoning, planning, creativity, and abstract thinking. If these abilities are performed by machines, they are called AI. The idea of AI is surprisingly ancient if it is based on the definition. Machines that learn, can make decisions based on what they have learned and apply it, they appear in different forms, ranging from Talos, the protector of the island of Crete, in ancient mythological stories written thousands of years ago, to the chess-playing robot (!) named "*Mechanical Turk*", which is also the subject of Edgar Allan Poe's article "*Maelzel's Chess Player*".[2,3] These examples, dating back to ancient times, have inspired modern AI applications. Although Leonardo Torres y Quevedo's (1852-1936) automaton, El Ajedrecista, which can actually play chess alone, and the calculator with electromechanical components appeared as early as the 20th century, the beginning of the foundation of modern AI science is accepted as the "The Dartmouth Summer Research Project on Artificial Intelligence" workshop held at Dartmouth College, USA in the summer of 1956.[4,5]

AI is defined as "the scientific understanding of the mechanisms underlying thought and intelligent behavior and their embodiment in machines" by the association for the advancement of artificial intelligence. In simpler words, AI is a computer science that involves creating programs that aim to reproduce human cognition and processes involved in the analysis of complex data.[6]

Artificial neural networks are flexible mathematical models that use multiple algorithms to identify complex nonlinear relationships within large datasets (analytics). Information enters the artificial neural network through the input layer, which is then fed through the multiple layers of hidden algorithmic processes. These processes are applied according to the weights learned in the machine learning processes. Finally, the processed data come out of the output layer. Artificial neural networks help the machine with deep learning. As we know, machine learning is the ability of the machine to automate a learning process, deep learning is defined as a particular type of machine learning that uses artificial neural networks. In deep learning, the machine uses an infinite number of layers where every layer within the neural network can recognize and learn different features specific to the dataset.[7]

2. USE OF ARTIFICIAL INTELLIGENCE IN DERMATOLOGY PRACTICE

Considering the widespread use of mobile devices, smartphone applications can be practical future platforms with numerous applications developed for skin cancer screening, public information, self-mapping, diagnosis, and research.[8,9] However, very few of these applications have been evaluated for

clinical efficacy, and these evaluations indicate poor diagnostic sensitivity and a high probability of misdiagnosis.[8,10] While real-life applications still require very cautious evaluation, dermatologists should be optimistic about taking advantage of the potential of AI applications to deliver high performance quickly and with practice. The development and improvement of these technologies require the support of clinicians to a great extent. It can be achieved both by taking part in studies for the purpose of comparing humans to machines and by presenting a large and diverse range of standardized clinical and dermatoscopic images for training practices.

2.1 Screening

Although the use of AI in the diagnosis of onychomycosis has been examined in a limited number of studies, the results show that this method is a technology that can help clinicians in the future.[11] The use of AI has been shown to increase the sensitivity of screening in onychomycosis, rapid diagnosis, and increased accessibility in the initial evaluation.[12-15] It is thought that the use of AI can take place in the field of telemedicine, which has rapidly entered our lives with the pandemic. Apart from its use in clinical practice, it will be used especially in the self-evaluation of the nails of the patients, thus reducing the increasing burden in the health system.[16]

2.2 Telemedicine Facility in Dermatology Practice

Telemedicine systems also make patient follow-up more comfortable, and while many patients have difficulty going to the hospital for follow-up, they can stay in contact with their physicians from their homes with telemedicine. However, physicians and patients should be aware of the limitations of teleconsultation. It is inevitable that some patients should be evaluated by face-to-face and physical examination, and physicians and patients should know which conditions require applying to a health institution, especially in cases such as serious reactions. In addition, the limits of these systems should be known by both physicians and patients, and the importance of face-to-face examination should not be forgotten when necessary. Although advanced technology medical systems such as artificial intelligence and telemedicine are promising systems in many branches of the medical world, these systems should not be used as a stand-alone diagnostic tool, the importance of the patient-physician relationship should not be ignored, and face-to-face physical examination should not be avoided if necessary.[17] When used in the right indications and in a healthy way, artificial intelligence and telemedicine systems will provide serious comfort in diagnostic processes and medical applications for both physicians and patients.

2.3 Dermatopathology

The whole slide images (WSI) system was approved in April 2017 by the US Food and Drug Administration (FDA) for use in the initial diagnosis in pathology.[18] Digitization of dermatopathology with WSI provides a rich archive. Thus, it will be very easy to select, collect and examine the samples used in the research to be carried out. Although all these

developments are promising, the transition to clinical practice is slow and AI cannot be used sufficiently in daily practice. Dermatopathologists are capable of recognizing many different pathological manifestations of cutaneous diseases and considering and ruling out many differential diagnoses. Most CNNs show that the image is positive or negative for a particular diagnosis.[19] In its current form, it is not possible to think that AI will replace the dermatopathologist, but it is clear that it is a good tool to facilitate workflow, education, and research.

Until now, the study of AI-assisted image analysis in skin pathology has largely focused on cancer diagnosis. Ding et al describe the development, workflow, and validation of an AI-powered analysis to segment and quantify immunostained skin samples derived from inflammatory skin disease.[20] They describe the process of explaining whole slide images of skin biopsies immunostained with various markers using automated technology. The application of two models in sequence facilitates accurate segmentation of epidermal and dermal structures. It also facilitates to rule of common artifacts and allows quantitative analysis of cell membrane, nuclear and cytoplasmic immune-stained signals. For example, the determination of skin immune-stained segment amount increases for the endotype description, verification, and development of biomarker signals. The results of this proof-of-concept study show that the AI-assisted model is effective in segmenting the epidermis and dermis and quantifying positive immunohistochemistry (IHC), immunofluorescence (IF), IHC/IF staining in inflammatory skin disease compared to manual methods. At this stage, they anticipate the main application of the model will be research, enabling accurate and time-effective quantification of immunostaining.

Similar studies have demonstrated high agreement between digital pathology systems and manual pathology for the detection and quantification of positive immunostaining.[21,22]

3. PRINCIPLES IN MEDICAL ETHICS

The most fundamental ethics based on ethical principles that concern the medical practice and patient care and treatment comprise non-maleficence, beneficence, respect for patient autonomy, and justice.[23]

3.1. Non-maleficence (Do No Harm)

The moral obligation of doctors is to act in the patient's best interests and not to harm them. However, this does not include only the medical aspects regarding patients but their overall quality of life: It falls under the responsibility of doctors to ensure and maintain their well-being while respecting the patient's individual desires and values.

In general, aesthetic concerns exist in every field of medicine but in dermatology practice. Physicians' diagnosis and treatment should be in cosmetic concern but absolutely ethical concern. Aesthetics in medicine should first be considered in the whole of medicine.

3.2. Beneficence

A current problem is that the patient is harmful to the person for the sake of "beauty", "attractiveness", or "in search of a

perfect body" requesting known applications from the physician. The main ethical problem is the reaction of the physician. If there is no indication, the physician should not apply.

Facial skin analysis systems used in cosmetics can make a person feel worse than they look. The analysis uses Ultraviolet light, daylight, and polarized light so all the hyperpigmentation problems and wrinkles can be seen in very detail. Physicians may want to refer patients to further procedures as a result of this analysis. Physicians should do so in a manner with the best interest of their patients as their highest priority, as it is in all other aspects of medical practice.

3.3 Respect for autonomy

The concept of autonomy is overarching and thus has implications for other key ethical themes including responsibility, informed consent, and privacy. However, it is also a central issue in and of itself and comes up across clinical and ethical discussions. We note that the term is used differently by ethicists than by engineers and neuroscientists. For ethicists, autonomy refers to an individual's capacity to self-determine.

The first problem we see often in cosmetic applications is that, the patient usually asks her doctor to apply a "trendy" form to her. She may want, for example, "prominent lips", whithout knowing if it is applicable to her.

Thus, ethical problems arise according to the patient's physical characteristics, psychology, wishes, possibilities, and the attitude of the physician.

3.4. Justice

A promise of machine learning in health care is the avoidance of biases in diagnosis and treatment; a computer algorithm could objectively synthesize and interpret the data in the medical record. Integration of machine learning with clinical decision support tools, such as computerized alerts or diagnostic support, may offer physicians and others who provide health care targeted and timely information that can improve clinical decisions. Machine learning algorithms, however, may also be subject to biases. The biases include those related to missing data and patients not identified by algorithms, sample size and underestimation, and misclassification and measurement error. There is concern that biases and deficiencies in the data used by machine learning algorithms may contribute to socioeconomic disparities in health care. This Special Communication outlines the potential biases that may be introduced into machine learning-based clinical decision support tools that use electronic health record data and proposes potential solutions to the problems of overreliance on automation, algorithms based on biased data, and algorithms not providing clinically meaningful information. Existing healthcare disparities should not be amplified by thoughtless or excessive reliance on machines.[24]

3.5. The other rules of medical ethics

3.5.1. Trust

Systems working within the frameworks of ethics and social norms will establish trust between systems and users through the

assurance of the protection of private data and the elimination of any potential biases in the decision-making process, as well as ensuring that the system works with existing legislation.[25]

3.5.2. Human autonomy and privacy

Individuals' right to privacy is an essential human right not to be violated by governments or unlawful surveillance by authorities. This basic human right is threatened by AI and Big Data, which features machine learning that requires the gathering and storage of data from the environment.[26]

3.5.3 Respect for Human Dignity

The use of advanced technologies does indeed carry the potential to interfere with the fundamental rights and freedom of humankind. It has been 25 years since the Council of Europe expressed through the Convention on Human Rights and Biomedicine (the Oviedo Convention, 1997) its commitment to: ''*... protect the dignity and identity of all human beings and guarantee everyone, without discrimination, respect for their integrity and other rights and fundamental freedoms with regard to the application of biology and medicine*"[27], identifying the ethical questions that threaten human dignity within the context of emerging scientific developments. Better governance and surveillance of such technologies are needed to prevent any possible misuse that might violate human rights (Council of Europa expression, 2015).

4. RISKS AND DRAWBACKS IN ARTIFICIAL INTELLIGENCE APPLICATIONS

The term black box is used for systems where we can see the input and output but not the kind of mechanism working inside. The best example of black box systems is deep learning models that use multilayer artificial neural networks. Due to the complex nature of the neural network in these models, which are used for applications such as diagnosis, prognosis, and outcome prediction, it is not possible to know clearly what the algorithm is doing in the background and which methods it uses. This situation creates a communication problem between machines and humans. Black box logic can be accepted in business decisions, logistics analysis, and human behavior studies without the need to explain the decision basis. However, in clinical applications involving vital decisions and margin of error, it is necessary to question how the system achieves results. There are also explainable AI models that can be used in such applications, in which the outcome behavior of a model can be predicted based on input parameters.[28] For example, based on the systems used for cancer diagnosis, while black box-based AI systems use the patient's data in the background and create the diagnosis, explainable AI systems interpret the patient data more transparently and provide the patient with an output about the diagnosis as well as the data on which he bases this decision. Recently, the use of explainable AI models has become common. In these models, it can be explained on what basis the AI makes the decision, and if it is thought that the decision made by the system

is wrong, this decision may not be taken into account. In applications where such systems are used, the responsibility may be assumed by the physician. However, this is unlikely to happen in so-called black box models, where the decision mechanism is unknown. In this context, physicians using AI systems should be alert to false decisions that the system may produce, re-evaluate in case of any incompatibility and doubt and clarify the situation.[28,29]

It is very important to protect all data used in a medical environment. In AI applications, care should be taken to protect such data from hackers and not to place it on unsecured or vulnerable servers.[30] If we give an example of prejudice other than health services, it has been revealed that Amazon's CV evaluation AI system shows that white men are more successful and gives privilege to this group in new hires and does not prefer women or people of color even if they are experts in their fields. Until recently, Google Translate translated the third person singular word as feminine (she) when talking about nurses and masculine (he) when talking about historians.[30] AI can serve to reinforce sexism, racism, and social prejudices. An algorithm designed to predict outcomes from genetic findings in health algorithms may not yield accurate results in populations with little or no genetic research. This may cause racial bias. In addition, people not presented in clinical trials and research data like persons with rare diseases, black, Asian, or minority population may also be affected by AI outcomes.[30]

5. CONCERNS ABOUT UNEMPLOYMENT AND LIMITATION OF COMPETENCE

Extensive automation of manual work through AI could result in short-term unemployment in low-income communities. However, it is thought that automation will provide great benefits by increasing the productivity and performance of health systems and increasing the efficiency of logistics and human resources. Nonetheless, it is difficult to make clear predictions for the future, especially due to political and economic uncertainty.[31] It is also suggested that the introduction of AI in medicine may negatively affect the professional autonomy and authority of physicians. Considering all these processes, AI algorithms have not yet been proven to be equivalent to the dermatological examination/diagnosis standards provided by physicians to patients.

Another important issue is the fact that there is insufficient data to educate the system, especially in rarer malignancies such as amelanotic melanoma. It is not yet clear how algorithms will perform when faced with entirely new, potentially malignant lesions. Although these lesions are rare, they are very important for patient safety.[16] AI will support physicians with its role as an assistant in clinical decision-making processes and will alleviate the workload of other healthcare professionals. With the widespread use of AI in medicine, the skills and expertise needed by all healthcare professionals will change, and medical education will need to be structured to meet the needs of this new situation.[29]

Patients who were informed about AI accepted the use of AI more readily. In addition, health literacy also plays an important role in adaptation to AI.[32] In a study investigating patients' views on the use of AI in different aspects of the medical workflow, patients preferred physicians to AI in most clinical tasks. The patients found the application of AI under the supervision of a physician more acceptable.[33]

AI systems have led to important developments in health services such as medical imaging, automatic diagnosis, and prognosis. These systems have the potential to make a revolution in various fields of medicine, as well as some risks and ethical concerns. All AI systems developed for medical applications should be used by preliminary information and it should be within the international consensus and ethical regulations ensuring the highest level of accuracy, reliability, security, privacy, and transparency. Legal problems that may arise with the use of teledermatology should be discussed and legal rights and limitations should be determined. First, teledermatology should be included in physician insurance in terms of legal problems that may occur in teledermatology practices. One of the medicolegal concerns in teledermatology practice is the protection of the personal data of patients. There is a possibility that the conversations made by videoconferencing can be followed by another person. It is recommended that the transferred medical photos and data be stored with an encryption method to prevent them from falling into the hands of unwanted persons.[34] Before the application, a detailed informed consent form should be obtained from the patients and the patient should be aware of the limitations and risks that this application may bring. In the content of this informed consent form, it should be emphasized that the physician can recommend face-to-face examination to patients if it is necessary. Consent regarding the protection of personal data and digital security should also be obtained from the patients who will be evaluated with the teledermatology method.[35]

6. MEDICAL DEVICES

Almost any product used by clinicians in patient management or medical procedures is considered a "medical device." It includes all medical staff such as surgical masks, dermoscopy, and video-dermoscopy. Medical devices (MD) placed on the market within the EU must have the CE mark. It is regulated by EU directives called Medical Device Directive (MDD) and Active Implantable Medical Device Directive (AIMDD) for many years.[36] After several events such as (1) the PIP breast implant scandal in France[37] and (2) the metal hip replacement issue, the EU decided to improve safety and control by strengthening regulation on medical devices.[38]

Clinicians should expect to see both positive and negative aspects of treatment.[39] Overall, clinicians can expect improved product quality, better validation of performance claims, and greater control of new releases/updates. It is hoped that all of these will benefit the patient. The new Medical Device Directive (MDR) will have a significant

impact on medical devices in Europe. It will benefit patients because it requires improved quality and adherence to manufacturers' claims of safety and performance. However, the updated dimensions of the devices will have an impact on the ease of use of devices, upgradeability, and price. On the other hand, there will be consequences for the availability of some devices, delays, or barriers to the new products coming out on the market.

7. COSMETIC DERMATOLOGY AND MEDICAL ETHICS

In cosmetic dermatology, the interest of patients increased in areas such as laser treatments, dermal filler applications, and Botox injections. This interest led to an increase in cash flowing into the market.[40] Where the money goes, ethical issues follow.[41] Cosmetic dermatology procedures are an integral part of dermatology applications. Should cosmetic dermatology exist? Various articles and books have caused a heated debate on such questions. Consequently, critical issues related to staying young began to be explored and discussed.[42] Physicians practicing cosmetic dermatology must have increased obligations to patients. We hope we can begin to address these concerns now.

8. REASONS COSMETIC DERMATOLOGISTS HAVE MORE OBLIGATIONS

Cosmetic dermatologists should pay attention to the following: they have duties that they owe to their patients and the public for various reasons. The morbidity inherent in the procedures, the vulnerability of patients, and the special privileges afforded to doctors require ethical behavior.[43] These procedures, let us shamelessly and apologetically state, are "*beautifications*". These are not life-saving procedures. Physicians dealing with aesthetic medicine also face natural conflicts of interest. Selling cosmetics services or products is highly attractive, especially in the periodically recurring customer market. Of course, all physicians face some form of this problem. Physicians' income depends on the procedures they recommend. However, when a surgeon insists that a patient has gallbladder surgery, the economic self-interest is less obvious even if that patient will benefit from the procedure. Physicians should pay attention to their ethical obligations just because they are physicians. All doctors should know and follow these rules: Choosing and/or suggesting the best for the patient's benefit, strictly avoiding harm, seeking justice for the patient's interests, and obtaining consent after informing the patient in detail. Certain areas of concern have also emerged where esthetic doctors may need to assume additional obligations beyond what is necessary for physicians.

8.1 Distinguish rhetoric from reality

Look at any magazine that targets women, like Vogue, Harper's Bazaar, Glamor, Elle, Instyle or Oprah. They are all loaded with advertisements that make bold, even outrageous claims about anti-aging skin creams. Companies feel pressured, even if they avoid wildly exaggerating the benefits of their products. Moderate slogans will not increase sales, according to marketing theories.

8.2 Questionable Claims, Questionable Language

Cosmetic companies have gone further by using medical code words such as "*clinical tests*" and "*dermatologically proven*" that give their products scientific credibility.

A Neutrogena advertisement for Rapid Wrinkle Repair® Regenerating Anti-Wrinkle Retinol Cream + Hyaluronic Acid offers "*Reveal visibly younger looking skin in just one week. Formulated with dermatologist-proven retinol, this anti-wrinkle moisturizer fights fine lines, dullness, wrinkles and dark spots. Plus, Hyaluronic Acid adds plumping moisture to help hydrate and rejuvenate the look of skin.*"[44] Should the consumer assume that this card proves the effectiveness of the product? Companies may provide such information on their websites. Even if such information is available to doctors or the public, it is unknown about the study or how to access it. As a result, it creates a dilemma regarding research that claims to prove the efficacy of a product. Neither patients nor doctors can verify or analyze data. Whereas unfounded claims about a skin care product are illegal under the law. The flow of such ads evokes science, evidence, and medicine. Although there is no trademark in the word "dermatologist", the profession certainly has an interest in not being stamped on anything and everything related to skincare. When anti-aging products are "*dermatologist recommended*", doctors seem to approve products of questionable effectiveness. While direct legal action is certainly an option, dermatology societies can also create their own advertisements that warn the public against marketing tactics.

8.3 Physicians as Business Partners in Premium Sales

The problem arises when physicians partner with cosmetic companies whose products are only available in selected doctor's offices. In the US, Prevage™, Allergan's entry into the antiaging market, is one such product. In the US only about 500 doctors nationwide sell the cream for $115.[45] Limiting the supply side of the supply-demand equation had an effect and articles in beauty and fashion magazines increased attractiveness.[42] The dermatologist should be careful when cooperating, otherwise they help sustain the imperfect market by selling the product. Of course, if consumers want to buy harmless but scientifically derived creams, they should have the opportunity. However, doctors must ensure that patients have a chance to make informed decisions. Again, doctors should help patients understand the data. The manufacturer explains: While antioxidant cream is only available through doctors, you don't need to make an appointment to buy it at most offices.[42] The patient has no chance to discuss the product or a healthy skin care regimen without an appointment. It is inappropriate for doctors to be in collaboration with an expensive but questionable product.

8.4 Review for Doctors Producing Cosmetic Products

If dermatologists are truly committed to their products, they have to do randomized, double-blind, placebo-controlled studies,

that support the safety and efficacy of a product. They should publish honest results in peer-reviewed journals. Doctors who make and sell their own products must have high standards to demonstrate the strength of what they sell as doctors. Even if they act like that, they can become manipulative. These doctors should remove medical implications from their products. They should not participate in the rest of the harmful competition in the cosmetic area. This is an unpleasant course. The best thing to do for physicians who turn to manufacturers and sales is to withdraw from practicing medicine and become producers. For example, if a physical therapist or orthopedic specialist decides to design and manufacture special shoe series and withdraw from the practice of medicine, he/she will do the right thing from an ethical point of view. While he/she advertises that his/her shoes are designed to be less painful than typical stiletto heels, he/she doesn't make pseudo-scientific claims about clinical studies of its product. Dr. Taryn Rose is an ideal example of this.[46]

Two professional medical organizations have declared position statements on dispensing in clinics. The American Medical Association (AMA) and the American Academy of Dermatology (AAD) care patients' interests first. The AAD's position is more specific and offers non-judgmental guidelines.[47]

8.5 Personal boasting and exaggeration

The task of marketing products honestly has an obvious consequence: marketing yourself. The dermatologist may use their educational links and board certification status to imply their specific expertise in cosmetic dermatology. Dermatologists working in the field of cosmetics should not do marketing by using their proficiency.

8.6 Adequate and Uniform Education Should Be Provided

Dermatology residency programs should ensure that their graduates receive adequate and uniform training in cosmetic dermatological procedures. Although the American Board of Dermatology review contains material on cosmetic dermatology, it does not guarantee that a dermatologist performing facial surgery is adequately trained.[48] Board certification does not necessarily inform or protect the consumer.

8.7 A Word on Informed Consent

All physicians should strictly adhere to informed consent. In cosmetic dermatology, a truly consent cannot be given if the patient does not have enough information about the risks and benefits of certain treatments and procedures. The problem is that the data on skin care products and advertisements mentioned above is not available or is clearly hidden from the public. According to one dermatologist, "*Epidermis damage caused by CO2 laser resurfacing, chemical peeling, and other popular cosmetic techniques aggravates the defect in barrier function rather than healing it*".[41]

Physicians should ensure that patients clearly understand the risks and benefits of products and procedures, especially when benefits are questionable. Doctors need to stand against the impact of television on patient perceptions and the informed consent

dialogue needs to be detailed and comprehensive. A truly informed consent process is even more important for cosmetic procedures than it may be in other areas of medicine. Of course, a physician must determine whether the patient's decision-making capacity is healthy before the approval process begins. For example, minors should be seen by their parents for a cosmetic procedure and decide with the family what treatments are appropriate for a teenager. Dermatologists may see patients with psychiatric illnesses more often than they expect. In fact, dermatologists may come across patients with Body Dysmorphic Disorder (BDD) more than any other medical professional.[49] Cosmetic procedures can attract patients with this obsessive need to change and correct perceived imperfections. One study found that 6 to 15% of dermatological and cosmetic surgery patients were eligible for a diagnosis of BDD, whereas only 2% of the general population met these criteria.[50] From a legal standpoint, these patients may not respond well to surgery and may sue or use violence against their doctors.[51]

9. DISCUSSION

Over the past decade, artificial intelligence (AI) has contributed substantially to the resolution of various medical problems, including cancer. Deep learning (DL), a subfield of AI, is characterized by its ability to perform automated feature extraction and has great power in the assimilation and evaluation of large amounts of complicated data. On the basis of a large quantity of medical data and novel computational technologies, AI, especially DL, has been applied in various aspects of oncology research and has the potential to enhance cancer diagnosis and treatment. These applications range from early cancer detection, diagnosis, classification and grading, molecular characterization of tumors, prediction of patient outcomes and treatment responses, personalized treatment, automatic radiotherapy workflows, novel anti-cancer drug discovery, and clinical trials. While AI is widely investigated in oncology, studies need to be performed to translate DL models into real-world applications. Barriers to improving doctors' acceptance and performance of clinically applied DL include the generalizability of its applications, the interpretability of algorithms, data access, and medical ethics.[52]

AI is a potentially transformative tool for improving inference from data for care and population health. However, while AI has demonstrated substantial potential in clinical applications, few large-scale deployments exist, and there are concerns. First, AI is a misleading term. In practice, it is more A than I. It is a defined process applied to 'narrow inference tasks' where large volumes of data are present and processing power is available to find associations. It is not, yet, a "general purpose" replacement for human intelligence or ingenuity. Second, whilst there are encouraging research findings in the use of AI in health care, little of this work has been applied in practice, rigorously evaluated, or exposed to peer-reviewed publications, while widely publicized positive findings have been

challenged. Third, where AI has been used in the broader economy, concerns have emerged regarding its negative consequences in relation to 'bias': where AI could amplify inequities in society. For example, in the United States, more African Americans have been denied loans or granted longer prison sentences compared to their Caucasian counterparts. For many, the concern is not only that "algorithms are for the most part reflecting back the bias in our world", but that they are doing so at a potentially massive scale and without due oversight. Collectively, these shortcomings produce '*algorithmic bias*', which at present, is not defined in the context of health systems.[53]

Cosmetic dermatology holds great promise, but this field is full of dangers that doctors must acknowledge and address. Fascinating actions and rhetoric can contribute to devaluation and deterioration. Dermatologists now appear in fashion magazines, Botox® advertisements, and articles showing their stylish wardrobes and they become quickly judges of beauty. These magazines give information about life, culture, and health and they also give messages about youth and beauty. Such messages can help improve cosmetic dermatology, but they can also be toxic. Dermatologists who are sensitive to the psychology of the patient population should reduce their involvement in fashion culture. More than 200 doctors purchased a cheaper version of botulinum toxin that was not approved by the Food and Drug Administration and some patients injected with this toxin became seriously ill.[54]

Similarly, patients who cannot pay the best doctors for cosmetic treatments may demand substandard care and may expose themselves to serious harm, such as permanent disfigurement and even death.

In medicine, there is always an aesthetic concern beyond technical or even scientific concerns. Individuals' physical and mental health problems and their conflict with scientific reality necessarily cause ethical debate. The concepts of disease and «deformity» that we encounter in medicine today, are fundamental in the physician-patient relationship since the earliest times of humanity. The doctors always try to reduce the patient's psychological and pathological problems. However, ethical concerns should not be forgotten when treating the field of aesthetics.[55]

The ethical obligations are very simple. Be honest in advertising, whether it's sales procedures or products. Be clear about education history and proficiency. Don't highlight weak school connections for the sake of marketing. Physicians may demand companies remove claims from their advertisements that imply their products are scientifically proven, dermatologist-approved, and better than they usually are, to preserve the integrity of the profession. Continue to have a medical dermatology practice and treat patients voluntarily if they cannot afford cosmetic procedures.

The key may be to follow old advice for doctors as Philosopher Ibn Maimoun says: "*Inspire me with love for my art and creatures. Don't let your thirst for profit, greed for fame,*

and admiration interfere with my profession because they are the enemies of truth and human love and they can lead them astray in the great task of caring for the welfare of their creatures."[42]

A serious consideration of obligations to patients is valuable for other reasons beyond ethical considerations. It is the reality of telling the truth about money and its effect on people. Patients can appreciate honest doctors and may prefer them to those who inflate themselves. Reducing professional responsibilities rather than increasing them dilutes the meaning of being a physician and there may be a threat of legal action.[41]

Physicians trade through their position and influence. Consumers may believe that an "*MD*" brand is better, effective, and real and that doctors aim to help patients rather than exploit them. While some dermatologists claim years of research and clinical trials, their claims may be as unfounded as cosmetic companies. Such claims are also not scientific evidence. "*Dr.*" or "*MD*" products or harmless logos on their label are easy to find. The temptation to create such products is obvious. The rewards are great: tens of millions of dollars in gross income. We haven't heard of gastroenterologists selling fiber-fortified cereals, bottling their own brand of water, or patenting a superior stool softener. Dermatologists abuse their doctor's status to sell a clinically unproven product. They become ethically suspicious, violating their obligations of being helpful to the patient, and offering the best for the patient. Using the power of a medical degree as a marketing tool may be clever, however, it also disrupts the "patient-physician" relationship built on "trust".

There are many opportunities for financial gain in the cosmetic dermatology world and ethics are challenged daily. Procedures that do not work but bring in money enter the market every month. Aestheticians and physician assistants are hired and may be paid on an incentive basis. "*Do I need Botox?*" is a question heard daily as well as "*Is eye cream necessary?*". Of course, individual practitioners must also consider these issues alone and decide after thoughtful analysis what makes the most sense, or feels most right, to them. The preservation of the patient's trust and of the sanctity of the physician-patient relationship should be placed on a par with patient welfare as the highest priority. Providing safety measures to prevent any direct or indirect coercion can only be possible through continuous ethical evaluations and monitoring of technological development.[56]

Legal issues aside, physicians have an ethical obligation to screen for this very common disorder among their patients. Since dermatologists are not trained to diagnose psychiatric disorders and it can be difficult to distinguish Body Dismorphic Disorder from the range of self-improvement desires, dermatologists should seek patient psychological consultation. As Ringel points out,[41] "*Systemic psychological evaluation of cosmetic surgery candidates should be as routine as screening for hepatitis or coagulation defects and should not be left to*

the uncertain idea of assessing realistic expectations."

Otherwise, the physician takes the risk of violating the ethical principle Do No Harm.

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