

Psychological Impact of Robotic Surgery on Patient Health: An Analysis

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ABSTRACT

Law, Society and Technology form an inseparable triangle. In the era of rapid technological advancement, law must act as a regulatory mechanism to ensure innovation must remain subservient to human dignity. The integration of technology in the Indian medical sector, mainly robotic-assisted surgery represents the medical innovation. It has revolutionized healthcare by offering enhanced precision, minimal invasiveness and reduced recovery time. However, the psychological dimensions of robotic surgery remain largely unexamined. The present study adopts a conceptual and doctrinal approach to analyse the robotic-assisted surgery which affects the mental health of patients across preoperative, intraoperative and postoperative stages. It examines fundamental factors contributing to fear, anxiety, technophobia and trust deficits arising from patients' unfamiliarity with machine-mediated procedures. The study explores the dynamics of trust between human expertise and technological mediation. The implications for empowerment, alienation and perceived control. The study discovers that patient psychological welfare is enshrined in Article 21 of the Constitution of India which guarantees the right to life and personal liberty. The study also states that informed consent in robotic surgery and requires revelation of technical risks, system limitations and the surgeon's role vis-à-vis the machine. Despite its benefits, robotic surgery presents significant medico-legal challenges such as high costs, liability attribution in case of malfunction, inadequate training protocols, data security and lack of specific regulatory frameworks. The study also concludes the general patient care in the age of surgical robotics and requires integration of psychological safeguards into medical and legal protocols. It recommends mandatory preoperative counselling, reviewed consent forms, structured training for surgeons and legislative reforms to redefine medical accountability from individual negligence to system liability.

Keywords: Robotic Surgery, Patient's Psychology, Informed Consent, Article 21, Medical Devices, Technology and Law, Doctor-Patient Relationship, Legal-Medico Liability.

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1. INTRODUCTION

Law, Society and Technology are an inseparable triangle of society. They are interconnected with each other. The era of growing technological advancements need law to ensure that they remain a servant to humanity rather than becoming a dangerous master. The technology brings changes and transforms norms, practices and functioning of society. It acts as a catalyst for social and legal changes. The relation between law and technology has a great impact on the patient. The integration of technology in Indian medical field has led to a revolution in the medical sector. It represents a fundamental shift in the doctor-patient relationship. Robotic-assisted surgery has transformed modern healthcare through precision, minimal invasiveness and reduced recovery time. With the integration of modern robotic technology, the patients have to adapt and trust in a machine's accuracy. The psychological dimensions of robotic surgery remain unrevealed. The study adopts conceptual approach to analyse how robotic surgery affects the mental health of patients.

This study examines the fundamental factors contributing to fear and anxiety in patients endured robot-assisted surgery. (1. Mohamed Jasim) It also examines pre-operative anxiety and post-operative surviving.

The study also talks about faith in robotic technology among patients and implications for informed consent. The psychological welfare of patient is integral part of article 21 under the Indian Constitution. The legal and medical frameworks must include psychological safeguards to ensure holistic patient care in the age of surgical robotics. (Mishra, 2023)The word "robot" is derived from the Czech word "robota," meaning "obligatory worker". It was first used in 1921. According to the Robotics Institute of America, a robot is like a human machine which is designed to function human's mechanical activities. The rules govern the robots such as, doing no harm to people, obeying human commands unless the first rule was broken and protecting oneself unless doing so against the first or second rule (Asimov). Robots were first used as alike to humans but with the span of time, many additional features

changed into intelligent machines. Robots in the healthcare industry perform tasks such as e-health, clinical treatments, artificial prostheses, rehabilitation and patient monitoring in a better way. Robots use mechanics and electronics to measure force, motion and space as well as sensor technology. The market for medical robots has been expanding and is being utilized extensively in healthcare globally. Social robots or surveillance robots being used to inspire and monitor patients. The growing demand for technology will rapidly enhance the application of cutting-edge robotics in the medical field.

In nations such as China, India and Brazil, the adoption of robotics is growing steadily. Robotics also leads in revolutionizing diagnostics, rehabilitation and patient care. They assist in tasks such as imaging and diagnostics, medication administration and therapy. This technological dominance in the medical field not only improves patient outcomes but also creates a safer and more efficient healthcare environment. Every change and advancement brings many issues and challenges along with it. The benefits of robotic innovation in the medical sector include medication supervision, speedy recovery of patients, improvement in patient outcomes. It helps in rehabilitation of the patient. It transformed the way medical services are carried out. With the help of technology, they are not confined to operating rooms only. Despite the benefits of robots in the medical field, several issues and challenges exist such as the high-cost factor, the need for proper and technical training of medical professionals and lack of infrastructure. The chances of errors or malfunctions of robots have increased. The failure or malfunction can result into losing of human life. The issues concerning liability and responsibility for medical error or failure raises. The matter of the patient's right to receive information and awareness on both segments i.e., the pros and cons of medical technology. Every new innovation needs a regulatory law to govern its practice, ensure accountability and protect the rights of the patient.

The evolution of robotic technology in medical demands a draconian legal framework to ensure patient rights and safety. Furthermore, these complicated systems require specialized training on the mode of operating these systems as well as for operators which will lead to potential skill gaps and reliance on technicians.

The concerns are also raised about reduced human interaction in patient's care and the risk of system failures or errors which could result into serious consequences. The term "fourth generation industrial revolution" used by Klaus Schwab, came to represent a paradigm of rapid economic growth. The present research also focuses on the comparison between traditional medical procedure and robotic assisted surgery. The traditional surgery relies on the physical feedback and on the flip side, robotic platform ranging from the pervasive da Vinci Surgical System to robotic driven microsurgical. This raises a serious question on accountability, if any medical tool exceeds its position as an instrument and become a self-sufficient agent which is capable of trespassing will result to effect human rights. The transition from human-controlled to robotic-systems controlled challenges the traditional legal and ethical boundaries of right to life. The law must reframe the medical accountability shifting from a focus on individual medical negligence to robotic surgery liability and define medical accountability in an era of automation

Thus, a legislative gap continues as Indian law still considered physician as the primary decision-maker and failing to interpret for software malfunctions, algorithmic bias, or manufacturer errors which may lead to a violation of a patient's constitutional protections and rights. The fundamental of this legal inquiry lies in the impact of robotics on the right to life and personal liberty as enshrined in article 21 of the Indian Constitution and international charters on human rights. The right acts as dual-edged sword in the medical field. On one hand, there is a positive obligation that the right to life includes the right to health and as robotic surgery. The state has a duty to ensure that such life-saving technology is accessible to all of us. On the flip side, there is a negative obligation regarding bodily and mind integrity and unwanted interference. Robotic intervention requires a higher standard of Informed Consent. A patient must be informed about technical risks such as system inactivity or mechanical failure. Malfunction of robot results into loss of life and is not just a medical error but a huge violation of the right to a dignified life.

2. OBJECTIVES OF STUDY

The following are the objective of the study:

- 1) To intellectualize pre-operative, intra-operative and post-operative

psychological responses of patient to robotic surgery due to unfamiliarity toward modern medical technologies.

- 2) To analyse the part of trust, empowerment and control in determining the patient outcomes.
- 3) To evaluate legal and ethical gaps in Indian medical frameworks regarding psychological care in robotic surgery.
- 4) To suggest policy measures for integrating mental health into surgical protocols.
- 5) To analyse the impact of robotic surgery on patient quality of life and mental well-being which is the integral part of article 21, as fundamental right of citizen.

3. ROBOTIC SURGERY VIS-À-VIS PSYCHOLOGICAL AND SCIENTIFIC OVERVIEW

Robotic assisted surgery includes the use of medical robotic devices to assist surgeons in execution of composite procedures with enhanced precision. The technology permits for smaller incisions, lessen blood loss and faster recovery times compared to traditional surgical methods⁵. This technique develops progressively dominant. It is imperious to inspect the psychological aspects which accompany the undergoing the physical aspects such as transformative medical experience. One of the primary psychological dimensions of robotic surgery is the expectancy of leading up to the procedure. Patients frequently struggle with a mix of emotions, extending from curiosity about the different medical technology to anxiety about the unknown⁶ method of treatment. The strangeness and unfamiliar of robotic surgery can evoke fear on patients. This fear harbours the concerns relating to potential complications or the reliability of technology. Addressing to these concerns, the healthcare providers had a crucial role in educating patients about the robotic surgery process. Clear and transparency in communication regarding benefits, hazards and expected outcomes can help in alleviating anxiety and empower patients to make informed decisions. Furthermore, the opportunities for patients to interact with the medical robotic system or providing virtual recreations can clarify the technology. It fosters a sense of control and familiarity. In Indian socio culture, low digital literacy and traditional

dependance on “doctor’s hands” may intensify the technophobia, especially among elderly and rural patients.

4. TRUST DYNAMICS: HUMAN EXPERTISE VS. TECHNOLOGICAL MEDIATION

The formation of trust is supreme in the realm of healthcare. The integration of robotic surgery requires patients to abide trust not only toward surgeons but also in the advanced medical technology. The trust involves a slight balance between the human expertise of the surgeon and the mechanical precision of the robotic system. It indicates patients to perceive the technology. The surgeons are capable to experience lesser levels of anxiety. Therefore, development of trust involves complete preoperative discussions and debates. Surgeons emphasize their expertise with the system's track record and collaborative nature of robotic surgery. The trust contributes to a positive psychological outlook and reduction in apprehension. It facilitates a smoother psychological transition into the surgical experience. In *Samira Kohli v. Dr. Prabha Manchanda*, the term “real consent”, which is based on true understanding and not only healing misconception. The Court emphasized that consent must be informed and voluntary. Elsewhere, the instant post-operative period, the psychological impact of robotic surgery extends to long-term considerations which is mainly concerns to patients' quality of life and mental well-being. The present study suggested that patients enduring successful robotic surgeries often experience improved quality of life. Yet, a subset experiences such as “post-robotic alienation”. In *K.S. Puttaswamy v. Union of India*, the court states feeling of interruption from their healing due to lack of human touch. The apex court held that mental integrity is part of right to life. The Court observed that “the right to life is not mere animal existence but a life with dignity”.

5. PSYCHOLOGICAL IMPACT OF ROBOTIC SURGERY ON PATIENTS' HEALTH

The following are the factor impacting the patient health are as:

1. **IMPROVED WELFARE AND REDUCTION IN ANXIETY:** Patients often experience lower postoperative anxiety, increased self-confidence and improved quality of life. These are largely driven by the expectation or experience of

less pain, faster recovery times and smaller scars.

2. **TECHNOPHOBIA AND MISTRUST:** Some patients experience fear, anxiety and distrust of the technology such as technophobia. Misconceptions that a machine is operating without human guidance can increase pre-operative stress.
3. **EMPOWERMENT AND ALIENATION:** The high-tech nature of the procedure can lead to feelings of empowerment and optimism for some, while others may find the technology emotionally alienating or complex.
4. **NEED FOR PRE-OPERATIVE COUNSELING:** Transparent communication and education about the role of the surgeon, as opposed to the robot alone, are critical for managing expectations and improving postoperative emotional outcomes.

6. ROBOTIC SURGERY: ISSUES AND CHALLENGES

The surgical environment is transformed rapidly with growing discipline of robotic surgery. The robotics has been everywhere and highly influenced in the medical field (T.Leal Ghezzi, 2016). This advancement brings changes. (A Tan, 2016) Robotic surgery has become a revolutionary area of medical field and transforming the surgical procedures in many specializations. The use of robotic surgery is tense with many medico-legal issues. The following are the major issues and challenges of robotic surgery: -

1) INFORMED CONSENT

Informed consent is very important practice (SN Pai, 2023) to enrich trust and transparency for the patients as well as surgeon. It acts as a medicolegal document which serves the central part in malpractice cases. Patients are required by law to be informed and acknowledged about the fundamental stages and progression of the surgical treatment. (S. Zacher) Therefore, it is very important to take permission of patient before robotic surgery (Patients Knowledge of and Attitude Toward Robotic Surgery for Pelvic Organ Prolapse, 2019). Most of the patients have no awareness of robotic surgery and they have misconceptions. These fallacies must be cleared on prior basis. (KS Chan, 2022) Patients have the misconception about the robotic surgery that the procedure will wholly perform by automated machine and function without the

assistance of a surgeon. There should be awareness of the benefits, dangers and other surgical alternatives to robotic surgery. The form on consent for robotic surgery does not certainly need to be completely different from that for nonrobotic surgery but it should be inclusive of information about the risks associated with the procedure and the role of the robot (Bishoy, 2005).

2) LEGAL LIABILITY

The issue on legal liability and accountability for robotic surgery is debatable issue. It is difficult to strike a legal balance between parties involved and assigning blame. The laws and regulations are constantly changing. There is a need of proper law and guidelines regarding the liability and accountability in case of errors, malfunctions during robotic assisted surgeries. The question arises on the liability of the surgeon, the hospital and the machine manufacturer. If the medical error occurs due to robotic medical devices which leads to harm and death of patient, the parties are partially liable or not. It also implies that this is a certain way for the parties to point fingers at one another in the event of litigation. (McLean, 2006) When it comes to compensating victims in these situations, experts have examined these cases and observed that there is some bias involved. Humans are predisposed to judge these cases more harshly, place greater blame on the automation and its developers, and be more likely to compensate the victims than in a comparable case in which no autonomous vehicle was involved, according to what is known as "blame attribution asymmetry bias". This prejudice may influence upcoming regulations and discourage the use of these technologies. (Liu Oeng, 2022) In this complicated legal situation that exists today, surgeons may thus wind up being the convenient carriers of liability. These new technical innovations don't seem to be directly covered by the laws that are in place, so new legal frameworks must be created to handle these situations (HR Sullivan, 2019).

3) EXPERTISE AND TRAINING

The safety of robotic surgery is still dependent on the expertise and training of the surgeon while using the robot, despite of the procedure is meant to reduce the human error. Additionally, the surgical and anatomical understanding of the proposed surgery while using robots requires extra information about the working of the robotic functions and how to

utilize it (E Palagonia, 2020). It has confirmed that obtaining specialized training in robotic surgery will reduce surgical errors. (S O Sullivan, 2020) The training of robotic surgery is still in its early phases, and most centres and areas have not yet codified criteria for robotic surgery. (CD Bahler, 2014) While training for robotic surgery is now available with increased exposure and opportunities and there is introduction of more structured training programs. (Falconer, 2021) In India the fellowship programs are required as the majority of resident training programs lacks in adequate exposure to robotic surgery. There are many misconceptions regarding the ease with which laparoscopic surgical training and expertise can be applied to robotic surgery. Including robotic surgery training in resident training programs has been a recent area of emphasis. (MH Vetter, 2015) This is based on the idea that teaching surgeons robotics early in their careers may be a good idea because robotic surgery will soon be a fundamental component of the majority of surgical subspecialties. Additionally, robotic surgery would get more recognition, acceptance, and proficiency as a result. It may not be as straightforward as it initially appears, though, as this strategy might sometimes backfire (BS Farivar, 2015).

4) COST AND MAINTENANCE

The high expense of purchasing and maintaining robotic devices is one of the key obstacles hospitals confront when using robotic surgery. Depending on the model and brand, the initial cost of a robotic surgery system can vary from hundreds of thousands to millions of dollars. There are also continuous expenses for training, maintenance, and instrument replacement. Many hospitals may find the expense of robotic surgery equipment exorbitant, particularly those with limited resources or smaller facilities. Patients' access to robotic surgery is so restricted, and hospitals are under pressure to demonstrate the ROI. Hospitals can look at a number of funding solutions, such as leasing or collaborating with equipment makers, to get around this obstacle.

5) FITTED INTO EXISTENCE WORK

For hospitals, incorporating robotic surgery into current processes is another difficulty. Several departments, including surgery, nursing, anesthesia, and administration, must coordinate when performing robotic surgery. To increase

productivity and patient safety, hospitals must make sure that employees are well-versed in the robotic system and that workflows are optimized. Also, in order to meet the special needs of robotic surgery, operating room layout and scheduling procedures may need to be modified. Existing workflows may be disrupted, thus careful preparation and cooperation are needed. Hospitals can create standardized procedures and workflows for robotic surgery in close collaboration with all parties involved to get beyond these obstacles.

6) REGULATORY REFORMS AND REIMBURSEMENT

Hospitals using robotic surgery face additional difficulties due to regulatory and reimbursement concerns. Hospitals must follow stringent regulations set forth by regulatory bodies like the Food and Drug Administration (FDA) regarding the usage of robotic systems. These regulations include reporting adverse events and guaranteeing patient safety. It may take a lot of time and resources to comply with these laws. Because payers may have varying policies and coverage criteria for robotic operations, reimbursement for robotic surgery can also be complicated. To make sure they receive a fair payment for the expenses associated with robotic surgery, hospitals must handle these reimbursement concerns. This can entail arguing for fair reimbursement rates and negotiating with payers.

7) ETHICAL AND LEGAL CONCERNS

In the context of big data, examining database ownership presents important moral and legal questions. It is crucial to ascertain who has ownership rights over the databases and the moral and legal implications of sharing and using such information. From an ethical perspective, it is necessary to carefully consider matters like informed consent, decision-making transparency, and assigning responsibility for mistakes or malfunctions. It's also critical to provide comprehensive, flexible, and unambiguous ethical and legal frameworks. In addition to addressing the present issues with AI, robotic surgery, and data privacy, these frameworks must to foresee and take into account upcoming advancements. We can protect patient rights, guarantee patient safety, and clearly define the duties and responsibilities of both autonomous robotic systems and human surgeons by doing this. This continuous

research and development is necessary to navigate the rapidly changing field of robotic surgery in a responsible and moral manner.

8) DATA SECURITY

Hospitals and Medical institutions must be ensured that the data of robotic surgery and patients must be stored safely and efficiently. (WJ Gordan, 2022). There are serious privacy and data security issues when patient data is collected and transmitted during remote surgery or telesurgery. Preserving patient data security and confidentiality is crucial, especially when dealing with sensitive medical information. To protect patient data during surgery, legal requirements and ethical standards must be set and strictly adhered to. This includes safe data transfer, storage, access restrictions, and thorough procedures for preventing and disclosing data breaches.

9) PATIENT'S SAFETY

There is a need of specific training for robotic surgery. It is to be certified that for performing any robotic surgery, the surgeon must complete a demanding course and training. Patient safety may be impacted by surgeon's training and expertise. By keeping an eye on the surgical event to manage any mechanical dysfunction and guaranteeing favourable patient results, the surgeons should perform safe surgery. They must inform patients about the probable dangers and advantages prior to the surgery. (Chakrabarti, 2022)

10) ECONOMIC DISPARITIES

Patients in underserved or economically challenged areas may not have as much access to modern surgical choices because to the high expense of robotic surgery, which can worsen healthcare inequities. Unfair access to the advantages of robotic surgery may result from patients in these locations needing assistance while receiving care from facilities that provide it. Policymakers and healthcare professionals must collaborate to solve these gaps by putting policies in place that guarantee fair access to robotic surgery, including mobile surgical units or telemedicine initiatives. (SP Kim, 2013).

11) ROBOTS AND SURGEONS

The use of robotic technology in surgery has progressed the discipline by providing accuracy and efficiency that can improve surgical results. But in the future, it is unlikely that surgeons would only use robots. Current robotic systems

might not be able to fully mimic the surgeon's special blend of creativity, adaptability and complex manual abilities. Depending on the patient's particular state, surgical operations frequently require quick decisions and adjustments areas in which human expertise shines. Robots offer stability and accuracy but they have drawbacks, such as a lack of haptic experience, sensory input and the difficulty of some processes.

7. INFORMED CONSENT AND THE PATIENT'S UNDERSTANDING OF ROBOTIC SURGERY

Informed consent is important part of medical ethics and the law. It ensures that patients must understand the risks, rewards and additional choices before approving to a treatment or operation. The medical robotic equipment is high-tech and originates with possible risks. The factor of informed consent is even more critical in robotic surgery. Doctors and other medical professionals ensure that patients must understand the universal risks of surgery and the specific risks involved in robotic surgeries. Patients should be expressed that robotic systems have risks which aren't existing with other technologies. The technology can interrupt, the program can have bugs, or the surgeon may not know how to use it properly. Many patients think that the computers run themselves, but the surgeon usually has direct control over them. The patient should be informed about the workings of medical devices. They are also acknowledged about the responsibility of surgeon and any risks or restrictions involved in it. It could also lead to legal issues if the patient's needs are not fulfilled. By the written permission form, there should also be information about how the surgeon is trained with artificial systems. If a surgeon isn't very good at using a specific technology, the patient should know about it because it could affect how well the surgery goes. If these parts are not present, patients were not provided with enough information to make an informed treatment choice. This could lead to claims of mistake or lack of informed permission.

8. RIGHTS OF THE PATIENT

1. PROVIDE MEDICAL RECORDS AND REPORTS TO PATIENT: It is the duty of hospital authorities to provide accurate medical records and reports to all patients or their caregivers.

2. PROPER MEDICAL CARE DURING EMERGENCY: Not any patient could be stopped from receiving emergency medical care from a government or private hospital sector.

3. INFORMED CONSENT: A medical professional should get the consent of the patient or their relative, spouse or guardian, in case of a minor. It should be in writing before execution of an operation.

4. MATTER OF PRIVACY AND DIGNITY: All medical professionals should maintain the uppermost level of confidentiality regarding the personal details of the patient.

5. RIGHT TO GET SECOND OPINION: A patient is free to go for a second opinion from any doctor of his or her choice and get additional information.

6. NON-DISCRIMINATION FACTOR: Doctors and medical employees cannot refuse treatment to patients on the grounds of gender, sexuality, caste, religion, race, place of birth or illness. They should not discriminate among patients.

7. RIGHT TO SAFETY AND QUALITY STANDARDS: It is the duty of medical institutions to provide a safe and clean environment for treatment of patients.

8. RIGHT TO CHOOSE OTHER TREATMENT: Once a patient or their relative, guardian is informed about their treatment, they are free to choose the treatment of action. They are not bound to follow a certain treatment without their will, even if the doctor believes it necessary.

10. RIGHT TO PROPER APPOINTMENT AND TRANSFER: All patients have right to obtain unified service and quality of care. This is to be upheld when the patient is referred to a different doctor or the patient is transferred to a different facility.

11. RIGHT TO PROTECTION FOR PATIENTS: Applicants of all clinical trials in India have right to claim compensation in matter such as trial-related injury or death, secrecy of personal information, etc.

13. RIGHTS BY BIOMEDICAL AND HEALTH RESEARCH: The National Ethical Guidelines for Biomedical and Health Research include human participants should followed and ensure the rights are given to the participants.

14. RIGHT TO TAKE DISCHARGE OF THE PATIENT etc: A patient is permitted to be discharged or leave the hospital. They cannot

be held without their will or kept in the hospital by force. Similarly, custodians of a deceased patient have the right to receive the body from the hospital.

15. RIGHT TO PATIENT EDUCATION: Patients have the right to receive education and information about the facts pertinent to their condition and healthy living practices.

16. RIGHT TO BE HEARD AND SEEK REDRESSAL: If a patient has a grievance against a doctor or the hospital management on the matter of quality of treatment, they have a right to seek redressal.

9. CONCLUSION AND SUGGESTIONS

Robotic surgical procedure signifies a standard shift in medical interventions and offers unparalleled precision and efficiency. However, this transformative technology brings out set of psychological implications for patients. The belief of foremost the procedure to the postoperative adjustment period. The patients also experienced with complex interplay of emotions perceptions and adaptations. The psychological impact of robotic surgery requires a complete approach which encompasses with clear communication, trust-building and support. By considering and addressing the psychological dimensions of advanced robotic medical technique, the healthcare providers enhance patient experiences, foster optimistic outcomes and contribute to sustained evolution of robotic surgery in the realm of modern medical sector.

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