

Surgery in the Digital Era: Traversing Advancements, Challenges and Future Frontiers

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In the ever-evolving world of modern healthcare, the incorporation of cutting-edge technologies has ushered surgical treatments into a new era.¹ This editorial digs into the disruptive influence of technical breakthroughs, specifically the merger of robots and Artificial Intelligence (AI) in the surgical scene of Pakistan. Furthermore, it investigates the potential of telemedicine to overcome healthcare gaps in rural or disadvantaged locations, while also addressing ethical considerations, implementation challenges, and future prospects.

The digital era has brought about a paradigm shift in surgical methods, with robotics and AI taking centre stage. Surgical robots, led by precise algorithms and real-time data analysis, have transformed the accuracy and efficiency of surgeries. These tools allow surgeons to conduct complex surgical procedures with more precision, potentially lowering the risk of errors ultimately improving patient outcomes.¹

AI, on the other hand, can also incorporate its cognitive abilities to the tasks at hand. From image identification to predictive analytics, AI helps doctors diagnose illnesses, plan procedures, and even carry out certain elements of the procedure. The predictive algorithms are already working in modern ICU's – giving early warnings to healthcare providers about impending sepsis, cardio-respiratory failure, and even suggesting interventions. This combination of human expertise and technical prowess represents a watershed moment for surgery.^{2,3}

While urban areas frequently reap the benefits of technological advancement, rural and neglected communities struggle with inadequate access to quality healthcare services. Telemedicine emerges as a potent alternative for closing this gap. In a country as culturally and geographically diverse as Pakistan, the potential to connect patients with experienced healthcare experts remotely is transformative.⁴ It eliminates lengthy commute, saving time and resources while also ensuring that crucial medical interventions reach people in need.

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The implementation of telemedicine in Pakistan has the potential to democratize healthcare by making it more accessible and inclusive.⁴

The predominant ethical concern is the employment of AI in decision-making processes. Finding the correct mix between surgical AI autonomy and human control is critical for avoiding unforeseen outcomes, ensuring patient safety. As we welcome the digital revolution in surgery, these concerns loom big.

Patient privacy and data security are critical considerations in an integrated healthcare ecosystem. To prevent unwanted access and potential misuse, sensitive medical information must be stored and shared securely. To overcome these issues, we must work together to bridge the gap through focussed education and infrastructure development. Training programmes for healthcare workers, particularly in rural regions, can extend the benefits of technological improvements. Establishing ethical frameworks that stress transparency, permission and accountability is critical as we navigate the new realm of digital surgery.⁵ Simultaneously, investments in strong telecommunications infrastructure are required to enable continuous connectivity for telemedicine efforts.⁶

The most significant hurdle in the implementation of sophisticated surgical technology in Pakistan is the digital divide within the country. Disparities in access to technology, infrastructural issues and variable levels of digital literacy, all impede the general adoption of digital surgical techniques.⁷ However, as we overcome these hurdles, the future of surgery in Pakistan is really promising. The continued integration of technology is more than just a trend; it is a transformative path towards more efficient, accessible, and patient-centered healthcare. The ongoing refinement of robotics, deepening integration of AI, and expansion of telemedicine services are poised to reshape the surgical, and overall healthcare scenario, in ways previously inconceivable.

Looking ahead, collaboration between the public and private sectors, as well as foreign alliances, will be critical

to realize the full potential of digital surgery in Pakistan. Government programmes that prioritize technology infrastructure, education, and regulatory frameworks will pave the way for a healthcare system that uses innovation to its full potential while adhering to ethical principles.

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References

1. Hernigou P, Lustig S, Caton J. Artificial intelligence and robots like us (surgeons) for people like you (patients): toward a new human-robot-surgery shared experience. What is the moral and legal status of robots and surgeons in the operating room? *Int Orthop* 2023;47:289-94. doi: 10.1007/s00264-023-05690-4.
2. Umer F. Could AI offer practical solutions for dentistry in the future? *BDJ Team* 2022;9:26-8. Doi: 10.1038/s41407-022-0830-1.
3. Loftus TJ, Tighe PJ, Filiberto AC, Efron PA, Brakenridge SC, Mohr AM, et al. Artificial Intelligence and Surgical Decision-making. *JAMA Surg* 2020;155:148-5. doi: 10.1001/jamasurg.2019.4917
4. Mahdi SS, Allana R, Battineni G, Khalid T, Agha D, Khawaja M, et al. The promise of telemedicine in Pakistan: A systematic review. *Health Sci Rep* 2022;5:e438. doi: 10.1002/hsr2.438
5. Umer F, Khan M. A call to action: concerns related to artificial intelligence. *Oral Surg Oral Med Oral Pathol Oral Radiol* 2021;132:255. doi: 10.1016/j.o000.2021.04.056
6. Shair W, Waheed A, Kamran MM, Kubra N. Digital divide in Pakistan: barriers to ICT usage among the individuals of Pakistan. *J Econ Impact* 2022;4:196-204. Doi: 10.52223/jei4032206.
7. Qureshi QA, Qureshi NA, Khan MZ, Nawaz A, Shah B. Issues and Prospects of e-health in Pakistan. *Mediterranean J Med Sci* 2014;1:31-52

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