

A STUDY ON SURGICAL ROBOTS AND THEIR RECENT DEVELOPMENTS

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Abstract – In recent years, Robotics has been rapidly developing with outstanding growth and innovation. This paper aims to analyze the key developments in the sub-domain of robotics such as medical robots, especially surgical robots. Surgical robots have evolved as a transformed force in the medical field in the way of performing complex surgical procedures. In this paper a comprehensive review of the latest trends, developments, and the challenges faced by the surgical robots and their instruments have been provided, including minimally invasive robotic surgery, telemedicine, remote surgery and robot-assisted surgery across various specialties in the medical field. This paper also provides the developments in surgical robots and their instruments in surgical precision, AI-driven decision support, and remote surgery capabilities, also provides the ability of surgical robots in the field of healthcare to address the challenges and enhance the specialized healthcare systems. This review offers a valuable resource for healthcare specialists, and researchers for gaining a better understanding of the evolution and the recent state of surgical robots and its impact on healthcare practices.

Keywords – Robotic surgery, Healthcare, Medical, Surgical Robots, Telemedicine.

1. INTRODUCTION

Robotics is concerned with the design and development of robotic systems. A robotic system has the capability of doing functions and activities for people to make their lives easier and to manage the typical work process. Robotics is a multidisciplinary engineering field that covers electrical, mechanical, computer science, bioengineering, and other fields. These technologies are being utilized to create a machine that can take the place of people and do human-like activities. Later, robotics technology allowed for the development of personal and service robots to aid people in a variety of industries. Medical robots and surgical systems are a fast-expanding sector within service robotics.

Evolution in Medicine and Computer Technology has opened massive steps in the field of surgery. Implementation of Robotic Surgery (RS) in the operating theatre improved the quality and risk of several surgical procedures. Particularly, robotic surgery is a minimally invasive method that reduces post-surgery recovery time. In this case, the surgeon follows certain steps to administer the instrument. The steps involve direct manipulation or control of access

through computers. Robotic surgery can be performed without the presence of a surgeon leading to the advantage of remote surgery. The surgical robot arms carry tools like light, cutting tools, and a camera [1].



Figure 1. Surgical Robot and Surgery Process.

2. EVOLUTION OF ROBOTIC SURGERY

The concept of robotic surgery evolved about 25 years ago to assist orthopedic surgery. Arthrobot was the earliest surgical robot invented in Vancouver in 1983 to place the patient's leg over the vocal remark of the surgeon. The robot performed almost 60 arthroscopic surgeries within the first 12 months [2]. In 1985, the PUMA 200 robot was used to orient the cannula during brain biopsy under CT guidance. In the later 1980s, Brian Davies et al., at Imperial College in London developed a PROBOT to assist the prostate surgery. The advantage of PROBOT was its size and accuracy. In 1991 Alberto and his team developed a robot for the resection of the prostate (TRUP) which was used in clinical trials [3].

In 1992, ROBODOC was developed for an orthopedic operation on the femur for the replacement of the hip [4]. Similarly, CRIGOS [5] and Maquet CASPAR [6] were also developed for orthopedic surgery. The surgical robot developed by Yulan Wang in 1989 was able to move an endoscope during the surgical Laparoscope operation [7]. This system was commercialized as AESOP (An automated endoscopic system for optimal positioning) and used in the operation room. Later the AESOP system is remodeled into Zeus Robotic surgical system with additional arms and different surgical tools [8]. In 1994, Steve Charles and the

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Current Developments in Glaucoma Surgery and MIGS J.R. Samples,I.I.K. Ahmed,2020-01-02 Successful interventional glaucoma remains a sought after goal for the glaucoma clinician for many reasons Medical costs compliance and adherence remain major barriers for the treatment of our patients A truly definitive treatment for glaucoma is most likely to be largely surgical as it is doubtful that patients will continue to use glaucoma drugs in the future for anything other than transient lowering of intraocular pressure In the coming era it seems probable that neuroprotection and neurorestoration will be combined with MIGS to lower pressure The different types of MIGS are increasing in proportion to their efficacy To date there are no fewer than 12 choices available to glaucoma specialists Choice of procedure depends on the underlying anatomy as well as the patient s individual characteristics Truthfully the number of available surgeries depends upon their taxonomy Most are based

on the outflow system and the canal as illustrated in this book

Surgical Research Wiley W. Souba, Douglas W. Wilmore, 2001-02-23 With the recent changes in the health care industry surgeons face increasing pressure to devote their time to their clinical activities thus limiting their research efforts It is essential that young and creative individuals are encouraged to perform research and are given incentives to participate in research under the mentorship of more experienced research investigators Surgical Research is the first book to include all the information necessary for the surgical scientist to perform a research experiment The editors have assembled outstanding expert investigators in multiple surgical fields and asked them to describe how they achieve their research accomplishments In Surgical Research these experts in the field have outlined everything involved in preparing and conducting a research project Some of the topics covered in the book include how to state a research question how to review the available information how to write research protocol how to obtain grant money for the experiment how to analyze the data and how to present the findings Also discussed are the ethics of animal and human experimentation along with the history and philosophy of surgical research To continue to advance technologies and surgical methods research must continually be performed Potentially great discoveries are being missed because would be researchers do not know where to start or how to conduct research and therefore do not even try This book provides prospective researchers with all the basic steps needed to perform a research experiment in the surgical field No student resident or fellow should start a research project without this book and no senior surgical scientist should be without it occupying a prominent position in the library Key Features The first complete compendium detailing the process and procedures to perform surgical research Provides details on and compares various methodologies A must have resource for the surgical resident fellow or scientist Includes a listing of resources and web sites to help the researcher even further

Recent Developments in the Field of Carbon Fibers Rita Khanna, Romina Cayumil, 2018-07-25 Carbon fibres are lightweight chemically stable materials with high mechanical strength and have state of the art applications in aerospace marine construction and automotive sectors The demand for carbon fibre based components is expected to grow dramatically with expanding opportunities for lightweight metals and composites Although this field has achieved a high level of maturity nanoscale developments in carbon fibres have seen dramatic improvements in the functions of conventional biomaterials and composites This book reveals several new developments in the field to enhance characteristics of carbon fibres and their composites novel applications for tissue engineering biological scaffoldings and implants recycling and reuse of end of life CFRP and manufacturing waste and other issues of concern in the field of carbon fibres

Key Topics in Surgical Research and Methodology Thanos Athanasiou, H. Debas, Ara Darzi, 2010-02-28 Key Topics in Surgical Research and Methodology represents a comprehensive reference text accessible to the surgeon embarking on an academic career Key themes emphasize and summarize the text Four key elements are covered i e Surgical Research Research Methodology Practical Problems and Solutions on Research as well as Recent Developments and Future Prospects in Surgical Research

and Practice **National Library of Medicine Current Catalog** National Library of Medicine (U.S.),1971 First multi year cumulation covers six years 1965-70 Recent Advances in Surgical Management of NSCLC Marcello Migliore,Domenico Galetta ,Masayuki Chida,2024-08-21 Lung cancer remains a leading cause of cancer related deaths worldwide and non small cell lung cancer NSCLC accounts for approximately 80% of all lung cancers Despite advances in therapy surgical resection remains the cornerstone of treatment for early stage NSCLC Over the past few years there have been significant advances in surgical techniques for the management of NSCLC Therefore there is a need to update the surgical community with the latest updates in the field This Research Topic aims to provide a comprehensive overview of recent advances in the surgical management of NSCLC We aim to address various aspects of NSCLC management including surgical techniques perioperative care and outcomes The collection will serve as a valuable resource and platform for thoracic surgeons and oncologists with the aim of improving outcomes for lung cancer patients **Surgical Research, Recent Developments** Academy of Surgical Research (U.S.). Scientific Session,1985-01-01 *Recent Advances in Minimally Invasive Thoracic Surgery* Yojiro Yutaka,Calvin Sze Hang Ng,2023-04-20 *Surgical Research* Hans Troidl,M.F. McKneally,David S. Mulder,A.S. Wechsler,Bucknam McPeck,W.O. Spitzer,2012-12-06 Surgical Research Basic Principles and Clinical Practice Third Edition is an excellent source book for the young surgical investigator as well as the senior investigator in surgery It is divided into nine sections The Surgeon as Investigator Reading and Writing Speaking and Listening Design and Methods Funding Implementation Analyzing Outcomes Ethical Issues and Perspectives The Third Edition has been updated and added to with 43 new chapters This book is of special interest to those surgeons interested in doing research However it also has many very interesting chapters that would help all surgeons in approaching their practice in a more scientific way With many of the foremost surgical investigators contributing this book is an excellent collection of chapters covering the entire gamut of surgical research **Journal of Rehabilitation Research and Development** ,1987 *Research Grants Index* National Institutes of Health (U.S.). Division of Research Grants,1965 *Index of NLM Serial Titles* National Library of Medicine (U.S.),1981 A keyword listing of serial titles currently received by the National Library of Medicine Recent Developments in Microbiology, Biotechnology and Pharmaceutical Sciences B. Sundaravadivazhagan,Sekar Mohan,Balakrishnaraja Rengaraju,2025-05-06 The Conference brought together innovative academics and industrial experts in the field of Medical Biological and Pharmaceutical Sciences to a common forum The primary goal of the conference was to promote research and developmental activities in Medical Biological and Pharmaceutical Sciences Another goal was to promote scientific information interchange between researchers developers engineers students and practitioners working in and around the world

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