

EXPERIMENTAL MODELS IN SURGERY

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ABSTRACT

A model refers to the replica of an object or an object that probably could exist. Although animals are used generally as models for human beings, they are also used in research to improve the health of other animals. These days, animal models (mainly pigs, but also dogs and sheep) are used for kidney transplantation, bone marrow transfer and heart surgery, to develop new methods for the cure or alleviation of organ diseases in humans. Variation in anatomy and physiology of different types of models with man and within species however prevents any one model becoming suitable for all purposes hence the need for selection of models in clinical research is important. Large numbers of students are not acquired the basic surgical fundamentals after graduation so Various manikins, Virtual reality (VR) simulators low and high-fidelity bench models etc. have been used as teaching and learning tools. Yogya sutriya chapter of sushruta samhita is a preliminary brainstorming context; a scholar can develop his surgical skill in a safe and regulated environment. In this article we tried to describe the type of experimental models with scope of selection of models with prominence in biomedical research.

KEYWORDS: Yogya, Experimental model, Computer Simulation, Animal model, Surgical model, manikins.

INTRODUCTION

An experiment is a procedure carried out to support, disprove or validate a hypothesis. Experiments provide insight into cause-and-effect by demonstrating what outcome occurs when a particular factor is manipulated in basic research. The aim of basic research is to gain knowledge and insights. Basic research has no immediate application but provides the scientific basis for further research and applications. Because of the similarity between humans and animals in terms of their metabolic processes and function of organs, knowledge gained in animal experiments can provide a better understanding of life processes and their disturbances in both humans and animals.^[1]

What is a Model^[2]

A model refers to the replica of an object or an object that probably could exist. Models have been employed in architecture, aerospace, petrochemicals, museums, exhibitions, films, and education as well as in trainings. Animal models have been employed in surgery to study, improve upon or develop new techniques. Although animals are used generally as models for human beings; they are also used in research to improve the health of other animals.

Types of experimental model

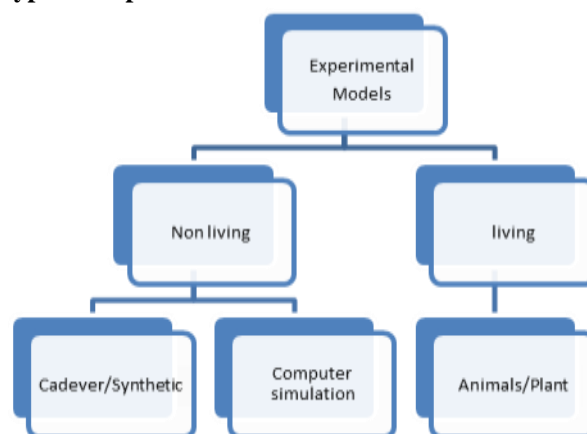


Fig. 1: Types of experimental models.

Role of model in Medical Research

Medical progress is inextricably linked with basic research. An example of this is the development of treatment methods for diabetes mellitus. In the 1920s, insulin was identified as a hormone that regulates blood sugar levels. Experiments on rabbits, dogs, pigs and cows helped to understand the effect of insulin on blood sugar levels and thus on tribute to the development of

new therapies. In 1923, the Canadian scientists Frederick Banting and John J. R. Macleod were awarded the Nobel Prize for their discovery of insulin.^[3]

Role of model in physiological research

These days, animal models (mainly pigs, but also dogs and sheep) are used for kidney transplantation, bone marrow transfer and heart surgery, to develop new methods for the cure or alleviation of organ diseases in humans. Artificial replacement organs, having first been subjected to standardised technical checks, are tested for their biological compatibility in large animals such as pigs.^[4]

Scope of model selection^[5] - The beautiful concept of experimental training has been amalgamated in current medical education and recommended to acquire basic surgical skills outside the operating environment (simulation-based training) prior to procedures on live patients but variation in anatomy and physiology of different types of models with man and within species however prevents any one model becoming suitable for all purposes hence the need for selection of models in clinical research is important. Large numbers of students are failed to acquire the basic surgical fundamentals after graduation so Various manikins, Virtual reality (VR) simulators low and high-fidelity bench models etc. have been used as teaching and learning tools.^[6]

Prerequisite of model selection in surgery- The use of animal models in surgical training will undoubtedly benefits the Patients if new techniques or improved proficiency of surgeons is attained or achieved. Some of these techniques are inadvertently associated with risks that can only be valued or experienced with living subjects. The use of animals for surgical training and demonstrations as well as the development of new surgical procedures is obligatory in situations when it is demonstrable that a suitable alternative is not available since failure to appropriately train the surgeons can have serious consequences for the society.

Animals as models for scientific research and training^[7]

Mice, rat, rabbits and guinea pigs are universally accepted and specially bred for scientific research. In spite of this however there are laws governing their use in experimental and training programs which center on prevention of pain and humane killing at the end of the study. Most animals are used in applied biomedical research, which aims to solve practical problems, and this work includes:

- In developing and selecting new medical pharmaceuticals;
- In toxicity (poisons) testing;
- In developing, testing, and improving surgical materials and procedures;
- The study of experimental diseases and pathology;
- Development and production of antisera and vaccines;

- Development of medical diagnostic techniques; and education and training.

Proper handling of experimental animals by researchers and animal keepers needs to be learned. This includes the routine tasks of animal keeping as well as blood sampling, injections and surgical procedures. Careful and comprehensive training of personnel should ensure that any suffering in animals is reduced to a minimum.

Plants based models for scientific research and training^[8]

Various objects like pumpkin-gourd, bottle-gourd, water melon, cucumber etc. are mentioned. Different excision techniques should be practiced on these objects.^[9] Incision should be practiced on a leather bag, urinary bladder or leathern pot containing full of water and slime. Scraping should be practiced on piece of hairy skin. Puncturing procedure should be practiced using veins of animal or on the lotus stalks which are smooth, spongy in nature. The probing should be practiced using holes in pieces of wood eaten by moths, bamboos, and mouth of dried gourd. Extraction can be practiced on fruits containing seeds like jack fruit, pulp of bilwa or on the tooth of dead animals. Drainage procedure should be practiced on a piece of Salmali wood coated with beeswax.

Virtual reality a new era to surgery^[10]

In many research programs around the world, combinations of computer software-based learning,^[11] video demonstrations, virtual reality systems, plastic models, full-body manikins, and plastinated specimens have been used to augment traditional didactic learning methods and substantially reduce and replace the consumptive use of animal.^[12]

CONCLUSION

Medical and surgical graduate in medical education has historically used a halstedian approach of “see one, do one, teach one.” Across most medical and surgical subspecialties, experimental models are recognized as a valuable tool in which simulation will shape the next era of medical education, postgraduate training, and maintenance of certification. A number of factors are leading the revolution in medical education. With the reduction in work hours, without an increase in the length of training, residents are at risk of not obtaining the training they need to practice independently.

In view of Acharya Sushruta, though a student has fully understood all surgical principles, but he cannot be competent without Yogya. He will be failed to conduct surgical procedures in human. To solve this problem and to build up sound knowledge in a surgical scholar, he has explained and demonstrated different kinds of Yogya Vidhi.^[13] It is our responsibility & need of hour to discuss and understand the connection of science with experimentation, and the linkage with animal experiments.

DISCLOSURE

The authors have no personal financial or institutional interest in any of the procedure, materials, or devices described in this article.

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