

Review Article

Animal models in surgical training: Choice and ethics

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Abstract

The use of animals in scientific research dates back to 500 BC, with research from Greece by Alcmaeon and other temporary scientists. Techniques for dissecting living animals were improved by Galen of Pergamum and his experiments were later valuable in the discovery of blood circulation in the 16th century. Until the 18th century humans were envisaged as the only alternative to animals in scientific research, and it was advocated that criminals in particular should be the subjects of vivisection. By the 19th century, however, even the use of cadavres came under regulation¹.

Claude Bernard and other leading scientists defended the focus on animal experimentation, which increased its use. Louis Pasteur, who pioneered research in infectious diseases, developed antibiotics following experiments in animals. Advocates of non-animal research, such as Lawson Tait², claimed that the diseases of animals were different from those of human beings and concluded that vivisection was worthless. In 1959 Burch and Russell formed the concept of humane research to help develop experiments that utilized animal-free techniques³.

Key words: Animal models. Surgery. Choice and Ethics

Uses of animals

Although non-animal models have played a pivotal role in biomedical research, animal research would continue to be fundamental for the development of medicine and surgery. Animals have been useful to man in several ways, these include: Food – meat, eggs, milk, butter ; at work ; Draught – plough, police duties, guards, lead dogs, military duties, detective. In ,Scientific research and teaching. In Sports and entertainment – zoos, racing, polo. Industry as a source of raw materials and by-products. Animals occupy their place in the ecosystem and play a part in the food chain They can be good companions as pets.,Animals in biomedical research Biomedical research, in general terms, can be defined as the study of living organisms and their interactions to: (1) improve medical, veterinary or biological understanding, in order to enhance or maintain the well-being of human beings, animals or the environment; (2) test the safety of chemicals or other products, to safeguard the welfare of

human beings, animals, and the environment; and (3) improve fundamental biological knowledge⁴. The objectives of biochemical research are to solve health related problems of man and animals resulting in better remedies, methods and techniques for the alleviation of suffering and advancement of health with the ultimate objective of enhancing man's well being. Nearly all natural sciences use animal experimentation to acquire new and expand on existing knowledge⁵. Increasingly however, there has been an outcry about unethical practices in the use of animals in biomedical research and training. Western nations, though there is considerable public opposition in some countries, including the use of violence against scientists and research organizations by animal rights extremists⁶. A hard blow has been dealt on animal model based research by the reduced funding and support in favor of non-animal model techniques which include synthetic models, cadaver models as well as computer simulations, these styles of instructions

are often unavailable in poorer developing countries, hence animal model based studies shall remain relevant in both biomedical research and surgical training⁵. Animal Laws, Rights And Liberation Law refers to the just interference of state in the interest and passion of humanity⁸. Little attention has been given to animal welfare in Nigeria, but the right of animals under captivity or domesticated, has been defined by both the Criminal code and Penal code of Nigeria as follows: The right to be free from hunger. The right to be free from discomfort. The right to be free from fear and distress and Freedom to express normal behavior. Animal laws These are laws relating to the responsibilities of owners and others in charge of animals, both in terms of the animals themselves and with regard to other people⁹. Owners are liable for damage if they were negligent, which usually means it is necessary to show that they did not take reasonable precautions to control the animal. Licenses are often required from local authorities for the keeping of dangerous animals, and there is provision for regular inspections of the animal by a veterinary surgeon⁹. Similar but more stringent regulations apply to zoos. Licenses are also required by any person who sets up in business as a boarding kennel for cats or dogs¹⁰. Cruelty to animals can amount to any of several offences, including failure to take action to alleviate an animal's suffering⁹. Anyone who wishes to carry out experiments on animals is subject to a number of strict requirements, which reflect the increasing controversy over the practice of vivisection. In the United Kingdom for instance, the scientist requires a personal license from a government minister, which may include particular requirements and must always include two conditions: that the suffering of the animal is minimized as far as possible in the context of the experiment; and that any animal will be killed as humanely as possible at the conclusion of the experiment. The particular experiment also requires a project license. Finally, the experiment must be carried out in a designated research establishment, with a named person responsible for the day-to-day care of the animals and a named supervisory veterinary surgeon⁹. In the Nigerian Criminal/penal code there is provision for penalty for harming animals in Section 495 and Cap. 196 of the penal code¹¹. The list offences of cruelty to animals to include: Beating, kicks, ill-treatment, over riding, over driving, overloading, torture, terrifying or cause or process or permit any animal to be so treated, Cause or permit unnecessary suffering,.

unnecessary suffering., Administration of poisons or injurious drugs, Operations without compassion. Fighting and baiting including management of such a place. Veterinarians are empowered by law and ethical concerns expected to be in the forefront in defending animal rights¹².

Types and forms of animal abuses

Universally, it is accepted that the following constitute abuses²⁴ on animals:

Beating. Overworking Poor housing Poor feeding practices. Sadistic, malicious or deliberate infliction of pain. Cause inhumane death. Cause avoidable harm Poor husbandry practices. Failure to alleviate or prevent suffering. Torturing animals. Turning a deaf ear or blind eye to such inhumane practices. Baiting and animal fights Animal Rights

Rights are a means of protecting disadvantaged individuals from the tyranny of the more advantaged ones¹³. Animal Rights refers to the moral right of animals to be treated with respect and without exploitation¹². Some people believe that animals have rights just as human beings have rights; opinions however range from extreme views of total animal liberation by animal rights activists to the practical improvement of the relationship between animals and humans.

The essence of Animal Right has been summarized in the Universal Declaration of the Right of Animals¹⁴ Viz.:

This declaration hereby proclaims that:

Article 1: All animals are born with equal due to life and the same rights to existence.

Article 2: 1. All animals are entitled to respect.

2. Man as an animal shall not arrogate to himself the right to exterminate or inhumanely exploit other animals. 3. All animals have a right to the attention, care and protection of man.

Article 3: . No animal shall be ill treated or subjected to "animal acts". If an animal must be Killed, this should be instantaneous and without distress.

Article 4:

A wild animals have a right to liberty in their environment where they should be allowed to procreate. Deprivation of freedom even for educational purpose is an infringement of this right.

Conveys or carries or permits to be conveyed or carried in such a manner or position to cause

Article 5:

Animals living traditionally in a human environment have a right to live and grow in the rhythm and under the conditions of life and freedom peculiar to their species. Any interference by man with this rhythm or conditions for purpose of gain is an infringement of this right.

Article 6:

All companion animals have the right to complete their natural life span. Abandonment of an animal is a cruel and degrading act.

Article 7:

All working animals are entitled to a reasonable limitation of the duration and intensity of work to the necessary nourishment and rest.

Article 8:

Animal experimentation, involving physical or psychological suffering is incompatible with the right of animals, whether it be for scientific, medical or commercial or any other form of research.² Replacement methods must be used and developed.

Article 9:

Where animals are used in the food industry, they shall be reared, transported, lairaged and killed without the infliction of suffering.

Article 10:

No animal shall be exploited to the amusement of man. ²Exhibitions and spectacles involving animals are incompatible with their dignity.

Article 11:

Any act involving the wanton killing of an animal is biocide, that is a crime against life.

Article 12:

Any act involving mass killing of wild animals is genocide, that is a crime against the species.² Pollution or destruction of the natural environment leads to genocide. **Article 13:**

1 Dead animals shall be treated with respect. 2. Scenes of violence involving animals shall be banned from cinemas and television except if for humane education.

Article 14:

Representatives of movements that defend animal rights should have an effective voice at all levels of government. The rights of animals like human rights should enjoy the protection of law. To conscientise the scientific community to this rights, the 24th of April has been observed as the day of laboratory animal protection.

Animal liberation:

"Animal liberation" may be a modern slogan, but as a philosophy and policy, it has its roots in ancient religious tradition. Christianity, Islam and Judaism are replete with verses advocating goodness to animals Prov. 12.10¹⁵ states, "The righteous knows the soul of his beast". The Holy Qur'an¹⁶ also states that " There is no beast on earth nor bird which flies with its wings, but the same are a community as unto you" (Surah An-am 6. 38). Furthermore several prophetic traditions emphasize goodness to animals such as

"Verily there are heavenly rewards for any act of kindness to a live animal¹⁷". The Jewish law on its part forbids anyone to sit down for a meal until he/she has fed his/her pet¹⁸. It can thus be seen that in incredible variety and actuality, religion blazed the trail for animal liberation. It was the first to campaign to make people realize the enduring value of animals, that they have rights of their own and are entitled to be treated with kindness and consideration in the same way that humans are.

Vivisection/ Surgical Training And Research Animal model use:

In both the human and veterinary medical practice, there continue to be developments and advances in surgery. Because of these developments, there still remains the need to teach practitioners new skills. Experimental and biomedical research in animals is however being increasingly being questioned because: It makes the false premise of using animals to replace humans in studies and rese/arches¹⁹. The false premise of being able to artificially create a human disease in animals²⁰. In tertiary education (Western countries), licenses have to be obtained to use animals to demonstrate known facts but not for undergraduates to acquire any form of manual skill. Video material and computer simulation alternatives must be considered before a license is granted.

Postgraduate research is bound by the same licensing guidelines; in addition, students must be supervised when learning experimental techniques. New licensees must receive training in their proposed technique and also general training concerning the use of animals in research²¹ Alternatives to vivisection Since 1976, the number of animals used for biomedical research has been in decline. This fall may reflect the rise in interest of molecular biology and the use of more *in vitro* methods and computer models. The increased costs of maintaining animals, the rise in public interest in vivisection issues, and the powerful lobbies against some forms of animal use, may also have influenced the decline. The aims of groups promoting replacement alternatives to animal studies are to develop procedures that do not use animals; reduce the numbers of animals required; or diminish the amount suffered by animals to meet the essential needs of humans and other animals. Under European, Canadian, and United States law, replacement alternatives have to be considered before animal experiments are proposed; procedures used should cause the least suffering or lasting harm to an animal, while providing satisfactory results¹⁸. Proposed

alternatives have included dry labs/workshops to familiarize students and trainees with the handling of instruments; use of cadavers as well as video and computer simulations for training. Ethics is the science of healthy relationship. Ethical approaches ensure orderliness, durable, honorable peace and a great sense of responsibility in the discharge of professional functions towards meeting the overall well being of the society^{22, 23}. A veterinarian is best positioned to ensure the general well-being and the execution of humane practices on animals. We are expected to among others ensure humane handling, appropriate treatment and prevention of cruelty. The veterinarian is also charged with the responsibility of overseeing studies involving animals. Ethical considerations make our relationship with our patients very important especially as communication between us is limited. It is also imperative that every veterinarian must make proper provisions at all times for the relief of pain and suffering of animals. Laws and Ethics of Animal Use and Association In several countries, including Nigeria, legal provisions governing the use of animals for research vary in the level of protection given to animals. In response to these worldwide variations, the Council for International Organizations of Medical Sciences published, in 1985, a set of International Guiding Principles for Biomedical Research Involving Animals, which were intended to provide a "conceptual and ethical framework" for countries with no legislation¹⁰. In the United States, the Animal Welfare Act operates as the main federal law relating to laboratory animals but state jurisdictions regulate research specifically whereas the Animals (Scientific Procedures) Act of 1986 controls work in Britain involving the use of "regulated procedures" on "protected animals". Researchers must gain acceptance from an establishment licensed by the Home Office to perform regulated procedures. These establishments include: laboratories in the pharmaceutical and chemical industry; science departments in universities and medical, dental, and veterinary schools; government departments; research institutes; specific departments in hospitals; and public health laboratories¹⁰. Whereas there are no definite national laws guiding or regulating the use of animals in scientific studies or training, several laws have been in existence to regulate the action of man towards animals. These laws have guided us on how, when and the manner in which we have conducted our trainings as well as scientific researches on animals. Several institutions and the University have in place guidelines for the use of animals in scientific studies and trainings. Ethical consideration in surgical studies must consider the suitability of the selected model, management of the animal throughout the study or training, euthanasia after the study/training all in an attempt to eliminate or reduce to a minimum discomfort and pain in the animal model. While not canvassing for a blind abolishment of vivisection, care should be taken not to create some detrimental effects antivivisectionists have often expressed such as: An abnormal disregard for the value of life, which can

lead to destabilization of students. Students assuming an erroneous attitude that animals are insensitive beings in which pain and suffering don't represent an emotional experience. In Nigeria, the enforcement of the provisions of these laws is vested in the police²⁵. Veterinary Officer^{26, 27} interested organization such as the Nigerian Veterinary Medical Association and the Nigerian Society for the Prevention of Cruelty to Animals. The Royal Society for the Prevention of Cruelty to Animals (RSPCA) is the oldest animal welfare organization in the world. From its earliest days the society has worked on two fronts: through its campaigns to turn public opinion against the ill-treatment of animals; and by direct action to prevent cruelty by appointing inspectors to help bring offenders before the courts very conservative once the contralateral kidney is absent or nonfunctioning⁶. Unity In Medicine The collaborations between the two surgical disciplines gave rise to the concept of "unity in medicine".

Schwabe²⁸ was recorded as being the first to elaborate this concept. This sort of relationship had regrettably been lacking in most developing countries, robbing the two professions the benefits of such an association **It is our believe that a surgical training session with animal models shall benefit the trainees in several ways among which are:** An opportunity to see and learn new surgical techniques. An opportunity to refine or improve their proficiency in older technique. Learn and practice the utilization of new surgical equipment etc. Model Selection 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. Specifically however, animal models have been employed in surgery to study, improve upon or develop new technique. The variation in anatomy and physiology of these models with man and within species however prevents any one model becoming suitable for all purposes hence the need for selection of models⁷. **The use of animal models in surgical training is justified. Patients undoubtedly benefit 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 appreciated or experienced with living subjects²¹.** Animals as models for scientific research and training Laboratory animals: 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. Primates: monkeys and apes are only approved in special cases where the use of other animals is judged to be unreliable and the need to use these animals, which are closest physiologically and anatomically to man, becomes inevitable

Others species such as dogs and pigs are also conditionally approved for scientific studies and trainings. Being monogastrics, they share similar physiological and anatomic features with man. Ruminants: rarely used as models in scientific research This limitation is largely due to the varied physiology and anatomy of these animals, which are distinct with that of man. Animal used in biomedical research and surgical training Worldwide, rodents are used mainly in biomedical research; the use of other mammals, birds, reptiles, amphibians and fish is small in comparison³. Most animals are used in “applied” biomedical research, which aims to solve practical problems, and this work includes: developing and selecting new medical and veterinary pharmaceuticals; toxicity (poisons) testing; 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 and veterinary diagnostic techniques; and education and training. Although animals are used generally as “models” for human beings, they are also used in research to improve the health of other animals. The use of animals for surgical training and demonstrations as well as and the development of new surgical procedures is necessary in situations when it is demonstrable that a suitable alternative is not available since failure to properly train surgeons can have serious implications for the society²¹.

Considerations in model selection

Whereas anatomic considerations such as size and accessibility of the organs and tissues of interest are the primary determinants for model selection in surgical training, physiological considerations are more important in toxicological and pharmaceutical studies. Surgical conditions of the following systems are largely reproducible in animals Therefore animals are suitable models for training as well as development of surgical techniques of this systems or organs viz.: Musculoskeletal system. Genitourinary system. Integument. Vascular and cardio thoracic surgeries and Digestive system among others.

Suggested Guidelines For The Use Of Animal Models In Surgical Training To ensure compliance with the law and ethical considerations the following guidelines are suggested in the conduct of the live animal surgical training sessions viz.: The use of animal models for surgical training shall comply with minimal ethical standards set out for animal welfare. Prior to the commencement of operative procedures, all participants should fully understand their ethical and legal responsibility regarding the use of live animals. Labs. for these training sessions shall be supervised to ensure compliance with these minimum standards. Trainees must be informed of the animal welfare requirements in terms of housing, use, care and feeding. Life models would be avoided if suitable alternatives can be developed or sought. The welfare

of the animals is paramount before, during or after the training. All animals shall be euthanized at the end of the procedures. Performance of multiple procedures is permissible provided anesthesia and or analgesia is adequate

Conclusion

In conclusion supporters of vivisection maintain and would probably continue to maintain that most significant advances in human health have involved the use of animals, that the human right to health ultimately takes priority over animal welfare, and that all responsible medical research involves the use of animals at some stage. Those opposing vivisection claim that animals have the same rights as humans; that advances in human health owe more to better standards of nutrition and hygiene than to experimental science based on the use of animals; and that there are valid and cheaper alternatives to animals which could be used in medical research. This write-up is not intended to join in a debate, hence the essence of organizing live animal surgical training sessions is to familiarize trainees with basic operative skills with the hope of developing or improving their manipulative skill and dexterity to become great surgeons of tomorrow. Vivisection has not and cannot replace the basic steps a surgical trainee must go through to learn surgery²⁹ viz.:First, learning from anatomic atlases.Dissection of cadavers. Observing experienced surgeons at work. Assisting senior surgeons. Performing simpler procedures under the supervision of more experienced surgeons. Graduating to being an independent surgeon. It is however is however irrefutable that these training sessions complement the standard protocol and pathway to becoming a surgeon. We do believe that the use of live animal models in surgical skill acquisition in developing countries (with attendant financial and technological constraints) remains relevant and justified. The technology to develop suitable non-living models or computer simulations simply doesn't exist. Whether or not incising and suturing an inanimate model is superior to the same practice in a live non-human model is a matter for thought, as antivivisectionists would want us to believe. The usefulness of animal models in other facets of science such as in pharmaceuticals (efficacy and toxicity testing), cosmetics (safety tests) as well as the development and utilization of synthetic tissues and organs remains questionable. Hence the interpretation and extrapolation of animal test results to humans should be a cautious exercise

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