Indian Journal of Animal Sciences **83** (7): 730–731, July 2013/Article

A simple, low cost, three dimensional model for teaching regional angiology and neurology

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Received: 19 July 201; Accepted: 11 February 2013

ABSTRACT

This paper describes a simple and low cost method for teaching veterinary angiology and neurology. The aim is to improve the quality of anatomical education through a student centred and clinically oriented approach. The acceptance of this method of teaching was surveyed among students. The results suggested that the model is well received by students.

Key words: Anatomy, Angiology, Model, Neurology, Teaching, Veterinary

Integrating anatomical knowledge in clinical practice can be quite tough, yet a systematic anatomical foundation is most essential for proper diagnosis and treatment of animal diseases. Veterinarians opine that when they want to use the knowledge of anatomy, whatever they have learnt is long forgotten. There is a general feeling that the present anatomy syllabus of B.V.Sc & A.H. course is so much stuffed with factual knowledge that reasoning and application is almost impossible.

The achievement of diagnostic and surgical capabilities in a veterinary surgeon is catastrophically affected by a non-integrated approach to angiology and neurology teaching (Lefroy *et al.* 2011). Customary teaching of angiology and neurology is based on lecture notes, line diagrams, charts, cadaver dissection and videos. While no method can fully replace learning on live animals, each of these methods have their own advantages and disadvantages.

Lecture notes tend to underestimate the cognitive leaps required between textbook lectures and dissection cases (Brewer *et al.* 2012). Two dimensional diagrams have clarity at the expense of detail. Students are unable to decipher the course of complex vessels and their branches from two dimensional diagrams. Cadavers demonstrate anatomical relationships but are of limited availability and also dissected parts bear no resemblance to the original animal body. Video demonstrations are effective but there is no touching of the animal body and the structures lying below have to be imagined. In view of these limitations a low cost and interactive method of teaching regional angiology and neurology is devised in the present study. Using low cost electric cables, a three dimensional (3D) colourful model was created to feign the outflow of arteries and nerves. The improvement of student understanding through the use of three dimensional models in comparison with current methods was assessed.

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MATERIALS AND METHODS

The programme used 3 pedagogical approaches to implement the forelimb neurovascular concept, viz. clinical simulation, study of subject matter and interactive model for reflection and repetition. This is in harmony with Kolb's experiential learning theory. A simple, life-size neurovascular 3D model was reconstructed using insulated electric cables purchased from a local electric shop. Wires of different gauges and colours were selected according to the structure to be constructed and its size. Red colour was selected for artery, blue for vein and grey for nerve. The cables were carefully moulded over a mounted bovine skeleton so as to reconstruct the blood supply in the species (Fig. 1). The construction of this model is very simple and it can very effectively simulate blood vessels and nerves. This method was also effectively used to depict arteries supplying the brain.

Emphasis was given to angiology although nerves were also demonstrated in this experiment. The model was introduced to 3 batches of students for the Gross anatomy II

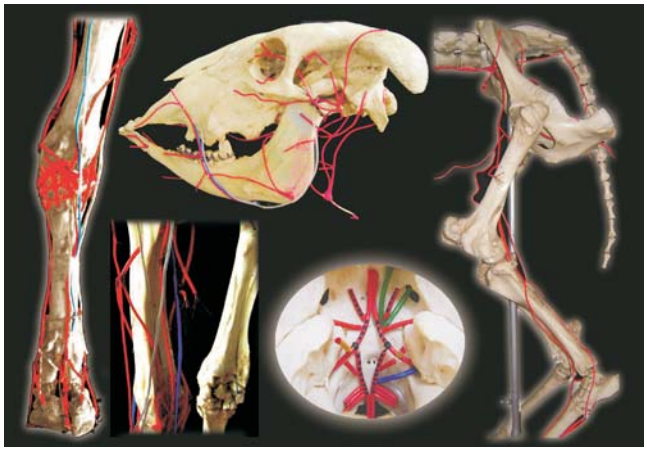

Fig. 1. Three dimensional models.

(VAN-121) course in the College of Veterinary and Animal Sciences, Pookode, Lakkidi, Wayanad, Kerala. Students were first taught using conventional teaching methods for angiology using only line diagrams and charts. They were later exposed to the three dimensional model teaching method along with a brief introduction of few clinical circumstances requiring the knowledge of angiology.

A feedback on the student attitude surveys of this learning substitute was conducted by opinion poll using a five graded linear scale (1 for bad and 5 for very good). Ninety one students (three batches) participated in the study. Two way analysis of variance (Snedecor and Cochran 1994) was employed to study the significant effect of the batch and the application of new teaching method. Repetition and reinforcement of the names of the vessels at appropriate intervals (touching and describing) was also done.

RESULTS AND DISCUSSION

Educational bodies recommend reduction in the lecture hours and increased problem solving activities through the use of computer based simulators while at the same time cutting down dissection of animals. This compromises the basic anatomical knowledge needed for clinical practice. In the present study, a low cost 3D model for teaching veterinary angiology and neurology satisfying these recommendations and at the same time providing clinical realism was developed as a part of renovation, which is a necessary part of every teaching laboratory.

Results of the comparison of student attitude towards traditional teaching and teaching using the model showed highly significant difference ($P<0.01$). The results strongly suggested that 3D models were effective to teach regional angiology and neurology. All the students responded in unison that they would prefer to use the model if only one learning method was available. Furthermore, after teaching with the newly developed model, students responded well to multiple choice questions. A hybrid approach combining lectures and demonstration using the model was found to be most effective method.

Nayak *et al*. (2005) suggested a hybrid approach to anatomy teaching combining problem based learning and database curricula. They suggested that the curricula must give an overall idea of the systems. Their survey results revealed that to improve anatomy education, it requires more clinical orientation along with cutting down of subject content and lectures, incorporation of self-directed learning and increase of small group activities. Our model best caters to all these needs. Some advantage of our model include life size simulation, integration of intra/interdisciplinary knowledge and increasing the confidence level of students by giving them a method that allows making and learning from their mistakes. In preparing this model, we can dynamically change views such as lateral, medial, at the same time and thereby demonstrate spatial relationships, an option no other teaching model for angiology at present can provide.

The model improves diagnostic capabilities and reduces unnecessary stress to animals during invasive procedures by making clinicians more proficient in anatomy. It also has utility in planning surgery for beginners, especially since the current educational system has cut down practical sessions on operative surgery. This model creates a realistic clinical environment in which students can enhance basic anatomical skills required for good clinical practice resulting in optimal animal production. The total time and cost required to make the bovine forelimb model was 2 h and ₹ 150 respectively. Compared with traditional methods, the model was preferred by students and gave a higher level of student satisfaction. Overall, the three dimensional model is a useful tool to accelerate the learning of regional angiology and neurology and is well received by students.

The paper presents a cheap teaching model that emphasized clinically orientated learning. It combines the simplicity of line diagrams at the same time providing life size simulation, a powerful tool for inducing clinical realism. The aim is to speed up learning and retain applicable information, mimic clinical reality and make learning enjoyable. The attitude survey results suggested that the model is well received by students.

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