Cairo University
Faculty of Veterinary Medicine
Anatomy and Embryology Department

Development of Computer Program Demonstrating the Surface Anatomy of the Horse Pelvic Limb

Thesis Presented

By

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بسم الله الرحمن الرحيم
(وَالْخَيْلَ وَالْبِغَالَ وَالْحَمِيرَ لِتَرْكَبُوهَا
وَزِينَةً وَيَخْلُقُ مَا لَا تَعْلَمُونَ)
صدق الله العظيم
الآية ٨ سورة النحل

Abstract

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Development of Computer Program Demonstrating the Surface Anatomy of the Horse Pelvic Limb

There is no doubt that surface anatomy has an important value in veterinary Practice. Therefore, this work aimed to develop an interactive multimedia computer program demonstrating the surface anatomy of horse pelvic limbs. The various data of the program were obtained from Forty-two pelvic limbs obtained from twenty-one, acceptable ethically sourced, horses. In addition to three live horses used to record video clip demonstrations. The developed program was based on various Anatomical techniques including preparations of bony skeleton, dissection of fresh and formalin embalmed cadavers, in addition to Elnady Technique preserved specimens. The multimedia assets involved text, images, video clips demonstrating the most prominent and palpable structures on the live animal. The program has a user-friendly interface, allowing ease of navigation. The main menu presents a button for each region of the pelvic limb including the pelvic, thigh, crural and pes regions. The anatomical structures within each region were categorized into musculoskeletal, vascular, nervous and others. Being available at anytime and anywhere, it encourages continuous learning. Moreover, it enhances active learning by presenting self-evaluation quizzes, in the form of multiple choice and true or false questions. The developed program will be of great benefit not only to veterinary students but to equine practitioners as well.

Keywords: veterinary, surface anatomy, equine, computer program, multimedia, pelvic limb, Elnady technique.

Dedication

I dedicate this work to my parents, my wife, my daughters, my sisters and my brother for their love & care to produce this work.

Acknowledgment

I would like to thank all the people that make this project possible and all the people who marked this episode of my life.

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List of Abbreviations

Abb.	Full Term
APR	Anatomy and Physiology Revealed
B. V. Sc.	Bachelor's degree in Veterinary Medicine Science
CAD	Computer-aided design
CDs	Compact Discs
CLs	Collateral ligaments
Cm.	Centimeter
CT	Computed Tomography
DDFT	Deep Digital Flexor Tendon
Dr.	Doctor
E-book	Electronic book
Ed.	Edition
E-journals	Electronic journals
et. al	and others
Fig.	Figure
gm.	Gram
h.	Hour
JPG	Joint Photographic Groups
LCD	Liquid Crystal Display
Ltd.	Private limited company
M.V.Sc.	Master degree in Veterinary Medicine Science
MB	Mega Bites
mm.	Millimeter
Mm.	Muscle
MP	Mega Pixel
MRI	Magnetic Resonance Imaging
Mt IV	Fourth Metatarsal Bone
Mt III	Third Metatarsal Bone
No.	Number
P I	Proximal phalanx
P II	Middle phalanx

List of Abbreviations (Cont...)

Abb.	Full Term
P III	Distal phalanx
Ph. D	Philosophy Degree
Prof.	Professor
PSBs	Proximal sesamoid bones
PVAc	Poly Vinyl Acetate
SDFT	Superficial Digital Flexor Tendon
TIFF	Tag Image File Format
U. S.	United State of America
Vol.	Volume
WMV	Windows Media Video
X-ray	X wave ray
%	Percentage
©	Copy Right
®	Registered Sign
°	Degree
3 D	Three Dimension

INTRODUCTION

With the advance of technology, and follow up of animal welfare organizations, the need for alternative in teaching and research has become necessary. Interactive teaching methods, virtual reality and simulations appeared recently to decrease the use of cadavers in anatomical studies. Application of computer- based programs is one of the successful alternatives for teaching veterinary anatomy. Surface anatomy allows student, surgeons and veterinarians to know the different structures of the body in living animal without dissection. Such skill is required for example in determining the accurate site of joint injection or nerve block, auscultation, and palpation which saves time and gives better results. So, computer programs are successfully used as an adjunct to traditional anatomy teaching methods **(Codd and Choudhury, 2011, Turney, 2007, Galland, Oberst, Lorenz and Mosier, 1995).**

In this study, the multimedia technology is used to develop a computer program demonstrating the surface anatomy of equine pelvic limb. Microsoft PowerPoint 2013© is the software used in this study to integrate the program interactive multimedia assets. The latter comprised explanatory text, images, video clips and audio narrations, in addition to questions and answers for student's self-evaluation. So our new computer program interface presents a button for each region of the pelvic limb, were anatomical structures in each region are categorized into musculoskeletal (bones and superficial muscles), vascular (veins, and arteries), nervous and others. Addressing the clinical relevance to such structures when applicable, made the program very useful to promote knowledge, enhance and facilitate teaching and learning of surface anatomy of equine pelvic limb for veterinary students and practitioners.

REVIEW OF LITERATURE

1- Pelvic region

Baxter (2011) mentioned that extensor muscles of the horse hip joint are the gluteus medius, biceps femoris, semitendinosus, semimembranosus, adductor, and quadratus femoris. Muscles adducting the thigh include the gracilis, sartorius, adductor, pectineus, quadratus femoris, and obturatorius externus. Slight abduction is exerted on the thigh by gluteal muscles.

Budras et al. (2009) reported that in the horse the sacral plexus of nerves is the continuation of the lumbar plexus; together they form the lumbosacral plexus. The cranial gluteal nerve accompanies the like-named artery through the greater sciatic foramen to supply the gluteus medius, accessorius, and profundus, and the tensor fasciae latae. The sciatic nerve also emerges from the greater sciatic foramen. Lying on the sacrosciatic ligament, it passes the hip joint dorsally and caudally, and as the largest nerve of the plexus enters the pelvic limb. The caudal gluteal nerve passes also through the greater sciatic foramen and accompanies like-named blood vessels into the gluteus superficial and into the vertebral heads of biceps and semitendinosus. The caudal cutaneous femoral nerve at first follows the dorsal border of the sciatic nerve but as the latter turns ventrally into the limb, it passes over the ischial tuber to end subcutaneously on the caudal surface of the thigh.

Baxter (2011), Budras et al. (2009), stated that the coxal tuber of the ilium of the horse lied under the skin as a nearly vertical palpable rectangle, whereas the ischial tuber, at the caudal end and is covered by muscles. The ventral surface of the pubis presented a groove for the accessory ligament and a wide acetabular notch.

Regarding the bones and bony prominences of the horse pelvic region, **Budras, Sack and Rock (2009**), mentioned that the bony pelvis comprised right and left hipbones (ossa coxarum) of horse which were joined in the pelvic symphysis and united dorsally by the sacrum. The hipbones consisted, from cranial to caudal, by three bones ilium, pubis, and ischium. The pelvic symphysis ossified in a craniocaudal direction.

Budras et.al (2009) and **Moyer and Schumacher (2007),** stated that the landmark for injection of the hip joint were the greater trochanter, which is sometimes difficult to palpate in horses with a well-developed musculature. The needle is introduced between the cranial part (convexity) and the somewhat more proximally directed caudal part (summit) in a slightly craniodistal direction. The needle is advanced along the neck of the femur up to a depth of about 13–14 cm.

Moyer et al. (2007) and Goody (2004) mentioned that the sacroiliac joint injection in the horse is performed by inserting the needle at a 60˚ angle to the vertical plane with the level facing upward through a stab incision created about 2 cm cranial to the contra lateral tuber sacrale. Advance the needle across the midline, aiming for a point midway between the ipsilateral tuber coxae and the greater trochanter of the femur . They added that the horse should bear weight equally on the rear limbs before inserting needle.

Rautenfeld, Negatsch and Awrenz (2002), reported that the lymph nodes in horse found in hip region are obturator lymph node, coxal lymph node.

Pilliner, Elmhurst and Davies (2002), reported that the skeleton of the pelvic limb of equine actually included the bones of the pelvic girdle: ilium, pubis, and ischium, known together as the hipbone (os coxae).