Clinical Radiology of the Horse
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Jan has specialized in equine radiography and has 30 years’ experience in this field. In 1975 she joined the Animal Health Trust in Newmarket where she gained considerable experience working with many internationally renowned veterinary surgeons. Since 1997 she has been working in private practice at the Willesley Equine Clinic in Gloucestershire.

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Preface

As the knowledge of equine radiology and radiography progressed, the need for a textbook specifically in this field became more obvious. We set out with the intention of creating such a book, but more particularly a book that would be of practical help to general practitioners, as well as providing specialist information. The authors all practise equine radiography and radiology daily, and we have pooled our knowledge to write a book by consensus, rather than a multiauthor text with chapters contributed by different people. There is no doubt that writing this way has tested the patience and endurance of us all, but we hope that it has enhanced the value of the book to the reader.

This third edition of the book has been significantly enlarged to include new information, to provide additional illustrations and line diagrams, and to incorporate the most recent relevant literature references. The authors have collectively gained considerably more experience in a variety of clinical situations, and in some instances have changed their opinions in the light of new knowledge; the text has been updated accordingly. Technology has advanced with the development of computed and digital radiography and a new chapter is now devoted to this subject. We believe that digital techniques can potentially enhance our ability to obtain high-quality radiographs and to provide more diagnostic information. However, unless attention is paid to the basic details of radiography, image quality may in fact be inferior.

We have replaced some of the original illustrations by digital images to demonstrate the quality that can be achieved. It was not possible to substitute digital images of all lesions, nor did we feel that this was appropriate, because we hope this book will be used by veterinarians both with and without digital or computerized equipment.

The authors recognize that there have also been advances in other complementary imaging techniques such as nuclear scintigraphy, diagnostic ultrasonography, computed tomography and most particularly magnetic resonance imaging. Where appropriate, brief references have been made to these techniques, but the authors have continued to focus the text on radiography and radiology, and advise the reader to consult other more specialized texts for information on these methods. Appropriate references are listed in the Further Reading lists.

We would particularly like to thank J. G. Lane, BVetMed, DES, FRCVS, and I. G. Mayhew, BVSc, DipOVc, PhD, MRCVS, DACVIM, for their assistance in reading and providing specialist advice on parts of the text for the first edition.

Radiographs for the first and second editions were provided primarily from the Animal Health Trust, and the Faculty of Veterinary Medicine,
Preface

University of Florida. Additional images for the third edition have also been provided by Willesley Equine Clinic and Avonvale Veterinary Practice. We also thank the School of Veterinary Science, University of Bristol, for several radiographs of the head, and the College of Veterinary Medicine, Swedish University of Agricultural Sciences, Uppsala, for a number of radiographs of the thorax and feet. We thank J. Weaver, S. Stover and T. O’Brien and the Equine Veterinary Journal for figures illustrating soft tissue attachments in the fetlock and pastern regions and B. Maulet, I. Mayhew, E. Jones and T. Booth and the Equine Veterinary Journal for figures illustrating soft tissue attachments in the stifle. Finally we must thank D. R. Ellis, BVetMed, DEO, FRCS, D. Hawkins DVM, M. Nowak DVM, P. Dixon MVB, PhD, MRCVS, R. Pilsworth VetMB, MRCVS, M. Ross DVM, A. Rucker, DVM, E. Santschi, DVM and T. Weinberger DVM for providing radiographs of a number of conditions that other archives could not provide.

We also thank Antonia Seymour of Blackwell Publishing for facilitating the production of this third edition. Her boundless enthusiasm for the project was a source of inspiration for us all.

Without the willing support of all the above, our many other colleagues within the profession from whom we have learnt, and our wives, husbands, partners, families and friends, this book could never have been written.

Jan Butler, Chris Colles,
Sue Dyson, Svend Kold
and Paul Poulos
Chapter 1
General principles

INTRODUCTION

There are many books that describe the principles of radiographic imaging. This book does not attempt to provide detailed information in this area, and readers who do not have a working knowledge of radiography are advised to consult one of the standard texts in order to obtain the necessary understanding of radiographic physics. This book does aim to provide up-to-date information specific to the horse. As various forms of competitive and pleasure riding become more popular, the demand on veterinarians to provide the highest quality of treatment is increasing. Radiography of the horse in sickness as well as in health, for insurance and purchase examinations, is increasing. The book is intended for all who radiograph horses, be they equine specialist, general practitioner or student. It gives information on radiographic techniques, equipment, positioning and views required to examine the various areas of the horse adequately. It also provides information on the normal radiographic anatomy of the immature and skeletally mature horse, variations, and incidental findings. Finally it gives information on the types of lesion that may be detected, with examples of as many of the more common problems as practicable, as well as brief clinical remarks where appropriate. The ‘Further Reading’ lists at the end of each chapter are not intended to be complete lists of every paper written on the subject of the chapter. They list references that the authors consider of particular interest, and that are complementary to the text. Many of these references give more detailed information in specific areas than can be justified in a textbook of this type.

Interpreting the clinical significance of radiographic changes is always difficult. We set out to indicate certain lesions that may always be regarded as clinically significant, and some that are known to have no clinical significance. The section in each chapter on ‘Normal variation and incidental findings’ attempts to differentiate between variations that have no clinical significance at any time (e.g. unossified radiolucent lines in the fibula, that represent remnants of separate centres of ossification) and those that may be clinically significant for a specific but limited period of time, and therefore require further clinical investigation to determine their significance (e.g. enthesophyte formation). The radiograph is only a reflection of the state of the tissues at the fraction of a second when they were radiographed. There are many findings which indicate a past event that has ‘left its mark’, but which is no longer clinically significant. For example, enthesophyte formation at the insertion of a ligament may indicate a sprain to that ligament at some time in the past. As enthesophytes take time to form, once they are visible on radiographs they no longer represent an acute injury,
but are the result of an incident that occurred at least several weeks previously.

Radiography is a continually developing science, and as more powerful and sophisticated equipment becomes generally available, the diagnostic possibilities for veterinary practitioners become ever greater. It is hoped that this book will enable veterinarians to get the best out of their equipment, to obtain diagnostic radiographs, and to give a correct and meaningful diagnosis from the radiographs. The information in the text has been collated from the literature where possible, and complemented by the authors’ experience. In some areas, however, there is no published work, or published information is contradictory. In these circumstances the authors have relied on their own collective experience, but have only presented information if all the authors are in agreement. (For example, reported physeal closure times for some physes vary widely between texts. The times given are based on the authors’ experience of radiographic closure, in some cases backed up by radiographic examinations of animals specifically to aid completion of this text.) The authors are experienced clinicians who routinely obtain and read equine radiographs, and it is hoped that the broad range of experience that they offer to the reader will prove to be of practical value. It is important to remember that, as radiography is a developing science, ‘new’ lesions and radiographic views are continually being found and described, and no text can hope to be complete when published, let alone as time progresses.

This text has made use of current terminology. Nomina Anatomica Veterinaria (5th edition, 2005) was consulted for anatomical names. Radiological views are described using the method advocated by the American College of Veterinary Radiologists. Reference to Figure 1.1 may help to elucidate

Figure 1.1 Correct nomenclature to describe various aspects of the horse.
the current terminology used. While at first sight this may appear cumbersome, it does provide a specific description of the views, which allows them to be reproduced accurately. Terminology in common usage is included in parentheses and serves only to maintain continuity with other texts and references. A glossary (Appendix C) is also included and lists former and current scientific terminology as well as common lay terms.

We have not set out to provide radiographs of every variation of all lesions. Rather we have given typical examples of lesions, and in the text have indicated how these may vary. We also hope that the reader will use this text as a basis to understand why certain types of lesions form, and the processes that are likely to cause them, so that an inexhaustible supply of radiographic variations would be superfluous. Although we have done our utmost to find radiographs that reproduce well, we ask the reader to remember that inevitably some detail is lost in the process of transferring radiographs to print, and in some cases the lesions depicted are far easier to detect on original films.

PRINCIPLES OF RADIOLOGY

The following paragraphs serve only as a reintroduction to the subjects of image production and differentiation. For more detailed information the reader is referred to the standard radiology texts. It is important that any radiograph is of maximum quality and yields sufficient detail to allow subtle radiographic lesions to be detected.

Production of x-rays

An x-ray beam consists of high-energy electromagnetic radiation. It is produced by accelerating a beam of electrons into a tungsten target. This results in the production of a beam of x-rays, and the liberation of considerable energy as heat. A smaller target area produces a narrower beam of x-rays, and better definition on the resultant radiograph than a larger area of the target. The area of the target struck by electrons is called the ‘focal spot’. Ninety-nine percent of the energy from the electron beam is given off as heat, not x-rays, and so there is a risk of the target being melted. Dissipating this heat and keeping the target as small as possible are major factors in design of x-ray tubes. For generators with a large output, the target in the tube is the edge of a disc. By rotating the disc at very high speeds during x-ray production, the area being heated is continually being changed, allowing a small focal spot in spite of high output. This is standard in large static x-ray generators. Smaller mobile or portable generators generally have fixed targets, which does limit the output possible. Any x-ray beam is made up of photons of mixed wavelengths. The older half- and full-wave rectification in small x-ray generators resulted in very marked variations in the energy of the individual photons of the x-ray beam. The high-frequency generators currently available have greatly improved the consistency of the x-ray beam produced, causing less scatter and a better resultant image.