Back pain

THE FACTS

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Line drawings
by
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OXFORD
OXFORD UNIVERSITY PRESS
NEW YORK TORONTO
1981

Oxford University Press, Walton Street, Oxford OX2 6DP
London Glasgow New York Toronto
Delhi Bombay Calcutta Madras Karachi
Kuala Lumpur Singapore Hong Kong Tokyo
Nairobi Dar es Salaam Cape Town
Melbourne Wellington
and associate companies in
Beirut Berlin Ibadan Mexico City

British Library Cataloguing in Publication Data

Jayson, Malcolm I.V.
Back pain. – (Oxford medical publications)
1. Backache
I. Title
616.7'3 RD768
ISBN 0-19-261285-9

Set by Hope Services, Abingdon
Printed in Great Britain by
Richard Clay (The Chaucer Press) Ltd,
Bungay, Suffolk

Foreword

by

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Last summer, I 'slipped a disc'. I could not point to any immediate incident as a cause; I woke one morning with some discomfort in one leg and when I got up I found that I could not move freely. I felt particularly aggrieved because this was at a time when I was hoping to tidy my mother's house prior to sale and to build a wall in the garden of my own house. I soon found these had to be abandoned. After a little wifely nagging, I went to the doctor who examined me and gave the curiously euphemistic diagnosis: I had a 'slipped' disc.

I tell this not because I wish to excite sympathy, but to produce my credentials for joining the club of 'back pain sufferers'. Quite apart from the restrictive physical practices to which I had to become accustomed, there were other perplexities. Why the smile when I hobbled into a room? There was a faint but unmistakable suggestion that I was a species of malingerer and that my problems could not possibly be as incommoding as I made out.

It was the first time I had been stricken with anything that changed the quality of my life. Now there were things I could and could not do physically. The advice I was given made it clear this was not something that would get better in the timescale of recovery from 'flu: about a year, if I took care of myself, I was told.

The other feature I noted was that unless I wanted to shackle myself in hospital, self-help was the order of the day. Where did this start? For me, in trying to understand what had gone wrong. Perhaps man travelled through the evolutionary time scale too rapidly from his happily buoyant position in water through the stability of a four-legged design on dry land to this two-legged defiance of gravity, and therefore we

all have a cryptic tendency to structural failure. Whatever the story, I would recommend this excellent book by Professor Jayson for all who wonder at the disabling nature of these human structural disorders. A knowledge of the cause of the problem predisposes the sufferer to adopt postures (both physical and mental) that can intelligently aid the process of recovery.

It is fashionable to believe that most diseases have an explanation ultimately revealing a fault at the molecular level. There is ample evidence for such a belief when we come to study, for instance, some hereditary diseases and a number of bacterial ailments. It is altogether more difficult to travel along a reductionist pathway in explaining the failure of structural systems, and the reason for this is implicit in the word *systems*. Just as it would be difficult to produce, *intact*, the individual elements from a prestressed concrete girder, so it is not yet possible (and may never be) to reconstruct the working physiological system from the assortment of specific molecules of which it is composed.

Research has produced an abundant understanding of what goes to make up the connective tissues of the body. The molecular components have been minutely described and the geography of their occurrence in tissues such as intervertebral discs of cartilage is well understood. A start has been made in modelling connective tissue, in an attempt to understand how the particular blend of components can in one mixture make bone, whilst in another cartilage or intervertebral disc. The analogy with the prestressed girder can be pursued: the dry cement and sand and steel reinforcements correspond to the molecular components of a tissue. When water is mixed and certain spatial arrangements are made, a girder can become capable of supporting structures, which neither concrete nor steel alone would do. It is when we come to do this reconstruction process with our biological systems that we cannot yet claim success, and one of the most exciting areas of research is finding out why we cannot reproduce the properties of the whole from the sum of the parts.

Foreword

I spend a good part of my scientific life attempting to solve problems such as I have just posed. I and the countless number of other research workers here and abroad recognize the importance of fundamental enquiry and thereby the need for money in supporting the experiments which must be set up. In the case of back pain charitable trusts in the United Kingdom deserve special mention and bodies such as the Arthritis and Rheumatism Council, the Nuffield and Wellcome Trusts all have generously supported what may often have looked like inauspicious ventures. Just as the molecules that make up the system are diverse, so are the talents of the research investigators. It is a marvellous human meeting-ground of, among others: engineers, surgeons, physicians, immunologists, anatomists, biophysicists, and biochemists, from whose committed perseverance to the problems of skeletal disorders come spin-offs additional to those of pure science. Because of such multidisciplinary research, the secretary sits a little more comfortably in her chair, the orthopaedic aids are a little better designed, and new materials for hip replacements appear.

But progress in research is gradual, as is recovery from these disabilities, so we should not expect overnight miracles. However, the optimism that all good scientists have must surely see to it that the presently intractable problems of back pain are eventually solved.

Preface

Back pain is so common and widespread that it is no exaggeration to say that nearly everybody suffers from it sooner or later. It is very difficult to comprehend the immensity of the problem, as back pain occurs at all ages and in all levels of society. More days off work are lost because of back troubles than for almost any other reason and this is so not only for the manual labourer but also for those with relatively 'soft' jobs, such as office executives.

Pain in the back is not a new phenomenon. Studies of skeletons from archeological remains show precisely the same types of change that occur today. The writings of the ancient Greek physicians describe very similar problems and indeed some of their forms of treatment are not so very different from those that we still use. Even examination of the skeletons of animals such as the enormous dinosaur in the Natural History Museum in London reveals similar types of wear and tear in the spine.

Although the back problem has been known for such a long time it is only quite recently that its importance has emerged and we have begun to appreciate the amount of suffering and the economic burden it produces. Increasingly the medical profession is asked how to prevent the development of back pain, how to pick out those who are likely to suffer from it, and the best forms of treatment. As soon as we start to ask these questions we realize that not all back pains are the same and that this sympton can develop for many different reasons. Some of these are clear cut and obvious but in many instances we are unable to sort out the precise cause of the trouble in the individual sufferer.

Modern science is increasingly aware of the need for further research in this field and the subject is of interest not only to physicians and surgeons but also pathologists, radiologists, psychologists, biochemists, bioengineers, and many other

disciplines. In the long run, the only way to achieve real advances is a proper understanding of what causes the pain and why it has happened. Often opinions are expressed, particularly by non-medical practitioners, that are not based upon scientific fact but rather on personal concepts which have not been tested in an acceptable way. Many of the myths that surround the whole subject arise because such views are put forward didactically and without the critical self-examination that is normally expected in medical circles. This lax approach applies equally to the many forms of treatment used for back sufferers. No acknowledgement is made of the fact that most episodes of back pain improve or get completely better spontaneously. It is a bit like having a cold and taking a medicine X: even though X is completely valueless, one can be sure that the cold will get better within a week or so. Many claims are made for the efficacy of various types of treatment without appreciating the natural improvements and fluctuations in the pain that normally occur. Individual anecdotal stories of dramatic improvements after different types of treatment abound, yet studies to demonstrate their true effectiveness can tell a very different story. The persistence of the back problem, despite all the claims made, points to the considerable difficulties with which we are faced. I firmly believe in the identification of the cause of the back pain in the individual and prescribing and determining the values of the appropriate forms of treatment for that particular problem. Modern ideas about pain and its control help us to understand and develop various types of treatment to control pain irrespective of the cause. Although this approach is very helpful in relieving symptoms it cannot solve the problem, as the basic causes are not tackled.

Advice for the back sufferer is plentiful. This book has been written to give the reader deeper insight into the whole problem. It endeavours to explain current views on the causes of back pain and the significance of the various changes that occur in the spine. I have described the various types of treatment that are in common use and reviewed whether they

really work. It does seem possible to minimize the back problem with postural and ergonomic advice and this also is included.

Back pain is the commonest form of rheumatism and its control is the biggest challenge in rheumatology. A proper understanding of what is happening is crucial for further medical advances. I hope that this book will be of help to back sufferers and stimulate further interest in the topic.

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February 1981

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1

Structure and function of the human spine

During evolution the animal kingdom split into two main groups: the invertebrates and the vertebrates. The invertebrates possess no internal skeleton but instead have a tough outer shell or exo-skeleton. The various parts of the limbs and trunk articulate with one another and movement is provided by muscles attached on the inside of this outer case. Such a structure is found in countless species, including insects and shellfish. In some the exo-skeleton has become thick and tough, providing protection for the internal tissues and acting as a suit of armour. However, the rigidity of this system produces considerable problems. For example a rigid system such as this cannot accommodate growth. A change of skeleton must take place at regular intervals. The very nature of the joints between rigid segments allows the animal to produce stereotyped movements but severely restricts its ability to adapt and evolve in relation to altered environmental conditions. These constraints have left the invertebrates relatively lowly members of the animal kingdom.

In contrast the vertbrates have an internal skeleton. In the trunk there is a backbone or vertebral column and in the limbs the various long bones. This skeleton grows with the animal and is flexible, as its components are connected by various types of joints designed according to the requirements at each site. Muscles, ligaments, and other structures are attached to this internal skeleton and can produce a subtlety and complexity of movements that are lacking in invertebrates. This type of structure can be seen in primitive animals such as the lancet, coelacanth, and even the modern dogfish. Natural selection has allowed the more successful species to flourish at the expense of those less well adapted to their environment. This process of evolution has led to the development

of modern species of fish, amphibians, reptiles, birds, and mammals. The internal skeletons of all these diverse groups show similar fundamental structures but with extreme adaptations to the species' way of life.

Nearly all animals walk on all four limbs with the trunk horizontal. Man is almost unique in standing upright balanced on two limbs. The advantages of this posture are obvious but clearly it also leads to considerable stresses on the skeleton. This alone could be responsible for many of the back problems that we suffer today. That is not to say that animals do not suffer from backache. Communication is difficult but we do know that dachshunds with their long and relatively poorly supported spines are very prone to this problem.

It has been argued that if the upright posture were responsible for producing spinal problems, natural selection would not have favoured the vertical position and we would all be walking on four legs. However, the span of life during effectively all the period of man's evolution was only some 20 to 30 years. As the majority of back problems occur at an older age, back pain would hardly affect the evolutionary process.

The functions of the human spine

The backbone or vertebral column is the principal supporting structure in the human body. Both upper and lower limbs are attached to it through a complex series of joints. The ribs are attached to the spine in the back of the chest wall in such a way that contraction of muscles allows co-ordinated expansion of the chest and breathing. Muscles, ligaments, and tendons connect various parts of the spine to each other and other structures, allowing a wide variety of movements.

In order to see the structure of the vertebral column, one can do no better than look at the work of Andreas Vesalius. He was an anatomist born in Brussels and was professor in Louvain and Pavia. He produced a magnificent book in 1543 entitled *De Humani Corporis Fabrica* – The Structure of the Human Body. This was a new departure in the study of

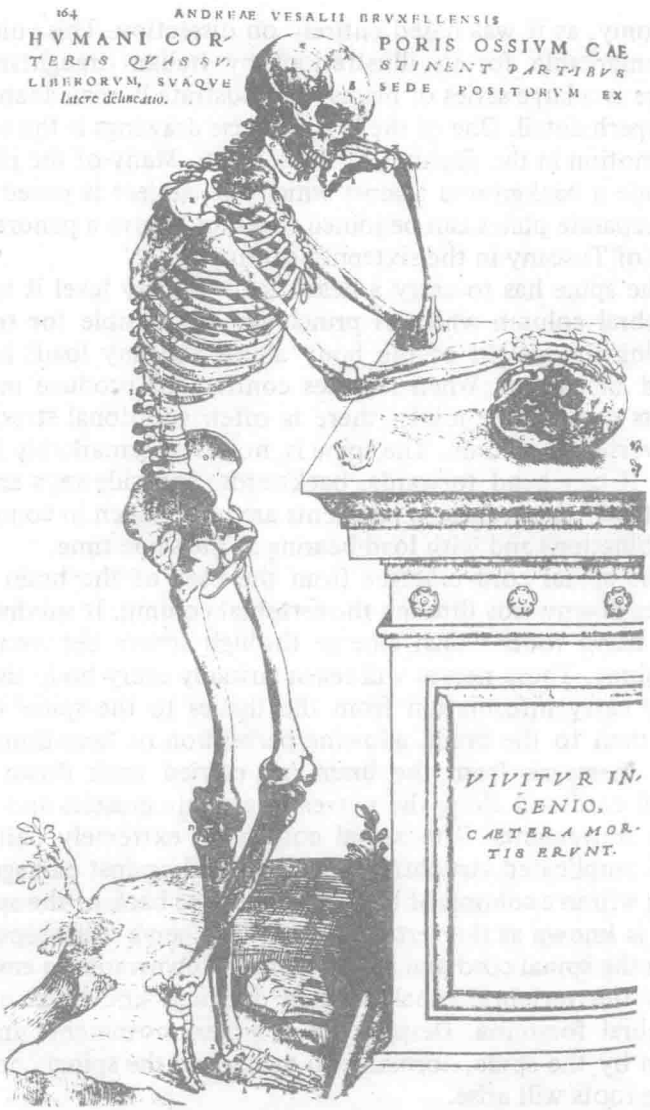

FIG. 1. The human skeleton. Illustration from *De Humani Corporis Fabrica* by Andreas Vesalius (1543)

anatomy, as it was based entirely on dissection. This volume is remarkable for its illustrations by Italian draughtsmen. There is a large series of plates that illustrate human anatomy in superb detail. One of the joys of these drawings is the sense of emotion in the postures of the subjects. Many of the plates include a background against which the subject is posed and the separate plates can be joined together to give a panoramic view of Tuscany in the sixteenth century.

The spine has to carry a heavy load. At any level it is the vertebral column which is principally responsible for transmitting the weight of the body above and any loads being lifted or carried. When muscles contract to produce movements or stabilize joints, there is often additional stress on the vertebral column. The spine is, however, remarkably flexible. It can bend forwards, backwards, and sideways and it can twist. Often these movements are undertaken in complex combinations and with load-bearing at the same time.

The spinal cord emerges from the base of the brain and passes downwards through the vertebral column. It subdivides into nerve roots which emerge through spaces between the vertebrae. These nerves will reach virtually every body tissue. They carry information from the tissues to the spinal cord and then to the brain, allowing perception of sensations. In turn messages from the brain are carried back down the spinal cord and along the nerves to activate muscles and produce movements. The spinal cord is an extremely delicate and complicated structure. It is protected against damage by lying within a column of bony arches in the back of the spine. This is known as the vertebral canal. The nerve roots separate from the spinal cord and pass obliquely downwards to emerge from the vertebral canal through openings known as intervertebral foramina. Despite the complex movements undertaken by the spine, normally no damage to the spinal cord or nerve roots will arise.

Apart from the structural functions of the vertebral column is the requirement that it should function for a lifetime of perhaps 70 or 80 years or even more. With all the wonders of

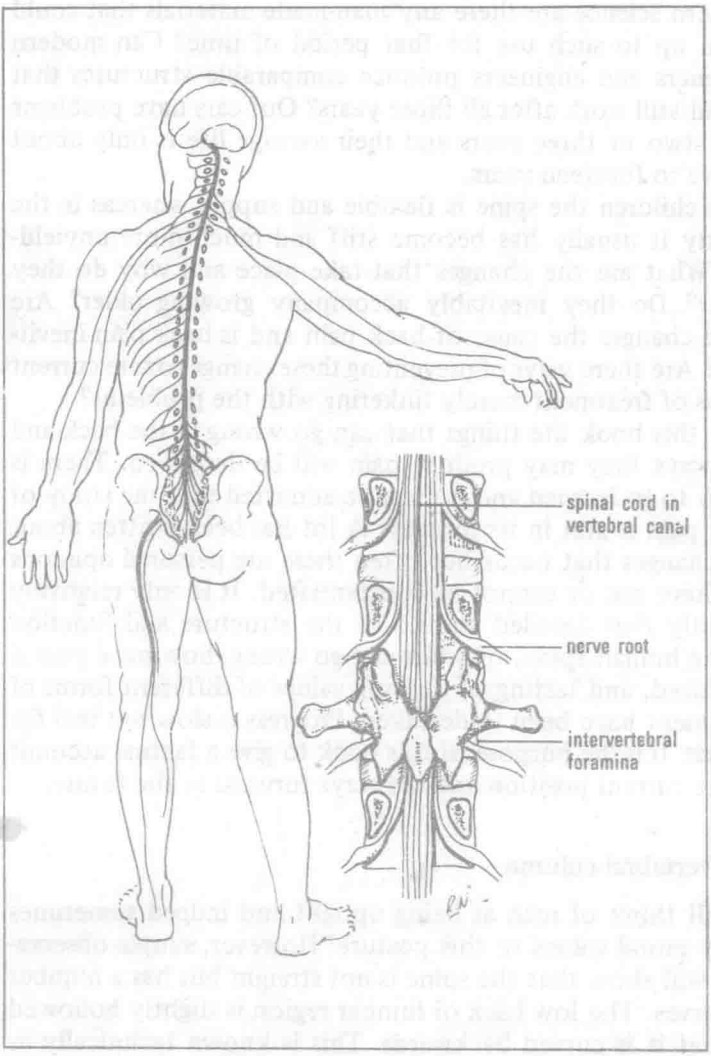

FIG. 2. The vertebral column, spinal cord, and nerve roots

modern science are there any man-made materials that could stand up to such use for that period of time? Can modern designers and engineers produce comparable structures that would still work after all those years? Our cars have problems after two or three years and their average life is only about twelve to fourteen years.

In children the spine is flexible and supple whereas in the elderly it usually has become stiff and much more unyielding. What are the changes that take place and why do they occur? Do they inevitably accompany growing older? Are these changes the cause of back pain and is back pain inevitable? Are there ways of preventing these changes or are current forms of treatment merely tinkering with the problems?

In this book the things that can go wrong in the back and the ways they may produce pain will be described. There is much to be learned and it must be admitted that the study of back pain is still in its infancy. A lot has been written about the changes that occur but often these are personal opinions and have not or cannot be substantiated. It is only relatively recently that detailed studies of the structure and function of the human spine, of what can go wrong, how back pain is produced, and testing of the true values of different forms of treatment have been undertaken. Progress is slow but real for all that. It is the purpose of this book to give a factual account of the current position and the ways forward in the future.

The vertebral column

We all think of man as being upright and indeed sometimes apply moral values to this posture! However, simple observation will show that the spine is not straight but has a number of curves. The low back or lumbar region is slightly hollowed so that it is curved backwards. This is known technically as the lumbar lordosis. The back of the chest is curved slightly forwards and the neck points slightly forwards. In the various problems that arise in the spine this normal pattern may change. The curves may be lost or exaggerated. There may be

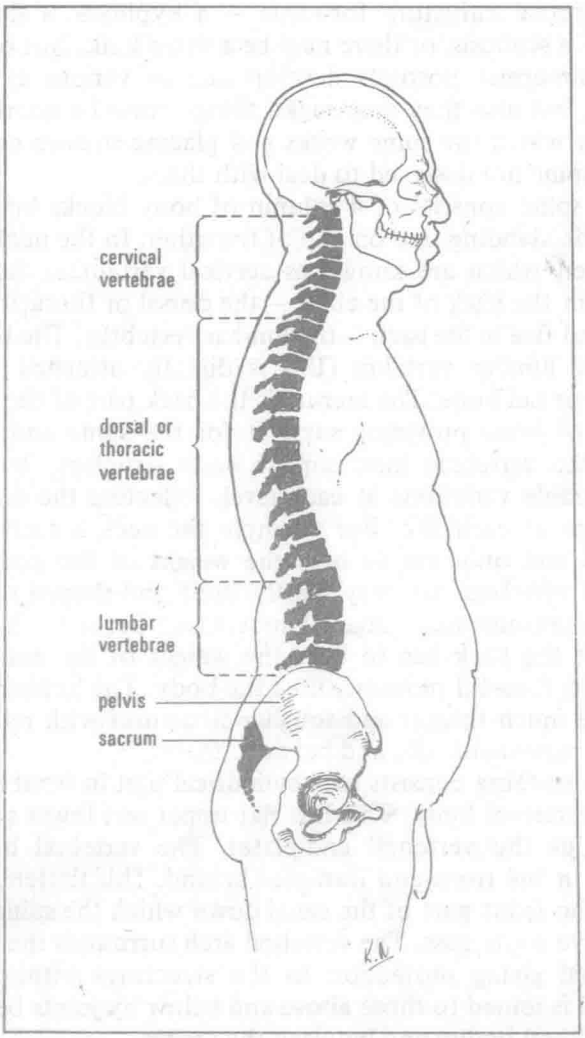

FIG. 3. The vertebrae of the spine

an abnormal curvature forwards – a kyphosis, a sideways twist – a scoliosis, or there may be a sharp kink. Not only do these abnormal postures develop due to various types of disease, but also they may make things worse by altering the ways in which the spine works and placing stresses on parts of the spine not designed to deal with them.

The spine consists of a column of bony blocks known as vertebrae standing one on top of the other. In the neck there are seven which are known as cervical vertebrae; there are twelve in the back of the chest – the dorsal or thoracic vertebrae; and five in the back – the lumbar vertebrae. The bottom or fifth lumbar vertebra (L5) is directly attached to the sacrum or tail bone. The sacrum is the back part of the pelvis, a ring of bone providing support for the spine and trunk.

All the vertebrae have similar basic structures but with considerable variations at each level, reflecting the different functions at each site. For example the neck is remarkably flexible and only has to bear the weight of the skull. The cervical vertebrae are very lightly built and shaped so as to allow a considerable range of movement between them. In contrast the back has to bear the weight of the trunk and transmits forceful movements of the body. The lumbar vertebrae are much thicker and tougher structures with relatively limited movements allowed between them.

Each vertebra consists of a cylindrical part in front known as the vertebral body. This has flat upper and lower surfaces known as the vertebral end-plates. The vertebral body is convex in the front and flattened behind. This flattened area forms the front part of the canal down which the spinal cord and nerve roots pass. The vertebral arch surrounds the rest of the canal giving protection to the structures within. Each vertebra is joined to those above and below by joints between the vertebral bodies and between the arches.

The intervertebral disc lies between the vertebral end-plates. It is a cushion of tissue that normally provides a springy and movable connection between the bones. Three types of movement occur at this cushion – flattening under loads, bending,