Operative Spinal Surgery

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PRACTICE OF SURGERY

Operative Spinal Surgery

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Preface

An increasing workload and expanding technical opportunities suggest that spinal surgery should be progressing towards the point of becoming an independent specialty. This idea is reinforced by the recent creation of several cross specialty spinal research societies, some specific journals and by the fact that many surgeons already make the subject their exclusive interest.

This book is addressed to surgeons in the specialities of orthopaedics and neurosurgery who desire to be better informed from a practical point of view. In Britain the creation of specialty fellowships in orthopaedics and neurosurgery makes this particularly relevant for trainees. It is not supposed to be a complete and exhaustive review or reference work but a useful operative handbook and guide. It concentrates primarily on a didactic presentation of surgical techniques, with discussion on indications and investigation where this is relevant to the choice of such techniques. There is a certain overlap, particularly in relationship to the variability of approach by different authors. Basic techniques and approaches described in some chapters may well be relevant to other areas as well. The subjects chosen are those that have been found most practically useful over a long period of time.

Many of the operative procedures are concerned with the management of degenerative disorders of the spine because they are relatively common. Rare conditions such as arteriovenous malformations are not discussed. In addition the choice of instrumental fusion techniques to be described is necessarily selective, but good descriptions of most systems are available in relevant commercial literature.

It is hoped that the book will be as enjoyable and productive to read as it has been to prepare.

1991 M.J.T.

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INTRODUCTION

The principles of operative spinal surgery can be stated quite simply. They are to obtain the appropriate access directly to the pathology guided by high quality radiography and other clinical assessment. The approach will be constrained by the local anatomy and the need to maintain spinal stability. The patient must be in the appropriate position and the optimum anaesthetic technique used. Surgical anatomy and technique are considered separately in the various clinical chapters. The other principles are discussed below. In addition comments are added on neurophysiological monitoring.

ACCESS

Many major reconstructive operations require extensive exposure. However the confined anatomy of the spinal canal and its contents, together with the desirability for low morbidity and rapid recovery, make much of spinal surgery an obvious target for the use of microscopic techniques.

Microsurgery involves an operating microscope, but in addition the whole approach to instrumentation changes. While a headlight and operating loupes can give a useful improvement in visibility, only adoption of the whole concept of microsurgery can give the optimum operating conditions (Fig. 1.1). Variable magnification from a wide angle and deep field of focus for the approach to higher definition for precise work is supplemented by variable, preferably fibre-optic, cold light illumination. This allows proper identification of the operated tissues, minimizing damage, bleeding and post-operative fibrosis. It also gives a better idea of the actual living pathology. A double binocular instrument allows three-dimensional orientation for the assistant; without this it may be difficult or unsafe to assist within the wound.

Even with good visibility orientation is not always easy. It is always useful to have an articulated skeleton spine available for reference.

Such improved visibility means that a narrow approach is feasible, reducing the local damage, bleeding and disturbance and resulting in quicker, less painful recovery. To allow this special narrow retractors are needed, modified for each approach. The more precise working and restricted access mean that other instruments need redesigning. Bone punches, microdissectors and rongeurs all have been modified for spinal surgery.

Perhaps the most important instrument is the bipolar diathermy. All diathermy in the spinal canal should be judicious and the vessels, like the epidural fat, should be preserved where possible; but if diathermy is necessary the use of bipolar forceps restricts its site of action avoiding damage due to current spread.

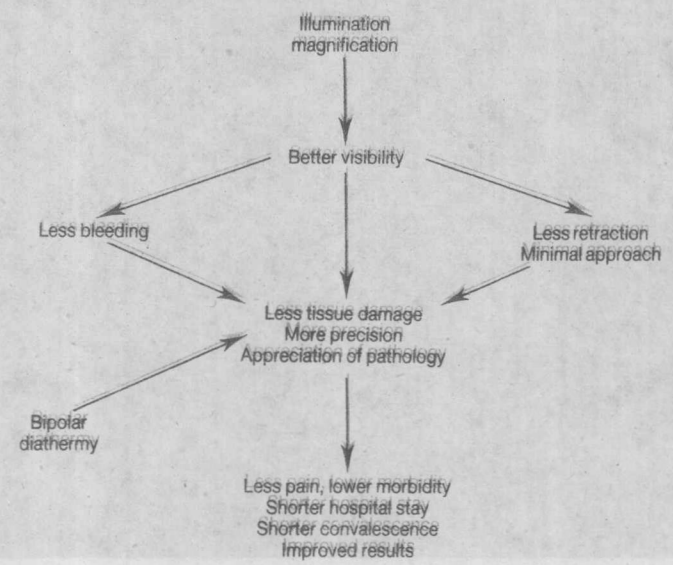

Fig. 1.1
Diagram to show the value of microscopic surgery.

With narrow access the chance of operating at the wrong level is increased. Microsurgical approaches must therefore be guided by intra-operative X-ray—preferably using an image intensifier both during the planning of the incision and later to check the level again if necessary. Any level in the spine can be found exactly by counting up from L5/S1 or down from C1/C2 using intermediate metallic markers as necessary and moving the image intensifier whilst screening continuously. Sometimes a localized recognizable piece of anatomy, such as the twelfth rib or a large osteophyte, can be used as the point of reference.

Spinal surgery can be one of the most interesting and demanding sub-specialities. Approaches can be made from almost any direction through the neck, thorax and abdomen (Watkins 1983). A high standard of anatomical knowledge and general surgical skill is necessary. In addition, for particular operations, a team relationship with thoracic and/or abdominal surgeons is valuable, usually speeding up the procedure and reducing the stress on a single operator.

RADIOGRAPHY

High quality radiography is a fundamental requirement for good spinal surgery. Recent advances in radiographic technique have made the precise anatomical and often pathological diagnosis much more accurate (Bradshaw 1991). This means that the planning of an operative approach can be more accurate and include more frequent use of microsurgery. 'Exploratory' spinal surgery should virtually never be necessary.

Standard X-rays

Plain film series are important in all cases. Some patients proceed directly to computerized tomography (CT) or magnetic resonance imaging (MRI) which leads to occasional misdiagnosis. Routine film series should be designed to obtain the optimum information, for example in degenerative disease of the cervical spine oblique views should be included. The use of a centimetre marker positioned at the plane of the spine is useful to allow an exact calculation of, for example, anteroposterior spinal canal diameter. Studies of the mobility and stability by flexion/extension films should be performed more often.

Standard tomography

This is a somewhat neglected technique since the advent of CT scanning but sometimes is an easier way to define the intervertebral foramen and facet joint anatomy in the sagittal plane and is the only satisfactory method of assessing the integrity of a fusion mass. Fractures in a transverse plane may be better visualized than by computed tomography.

Contrast myelography/ radiculography

This is still in most countries the quickest and most cost-effective way of screening a whole area of the spine. A significant number of diagnostic delays have occurred recently due to the wrong level of the spine being scanned by CT or MR, the diagnosis being resolved by subsequent myelography. There is seldom a complete block to water-soluble non-ionic contrast media if a little time is allowed. False negative results may occur particularly in the thoracic region. Dubious or false positive results can usually be clarified by the addition of CT scanning subsequently (v.i.). It is now our policy to scan routinely all patients undergoing myelography after a delay of a few hours. The CSF should always be sent for routine diagnostic testing.

CT scanning

This technique gives the most information about the bone structure and is therefore of particular value in degenerative disease, trauma, bone tumour and spinal deformity. Such information has revolutionized the approach to certain pathologies allowing both more precise and restricted surgery (e.g. intersegmental decompression, Ch. 11) and more radical techniques (e.g. vertebrectomy for monostotic tumour, Ch. 20). The extent of traumatic disruption is particularly well shown and there seems to be an argument for screening all incomplete spinal injuries acutely although it should be borne in mind that the local pathological situation is not always related to the neurological status or outcome. Computerized three-dimensional reconstruction helps the understanding of the more complicated cases, especially spinal deformities, but two-dimensional assessment of scoliosis may be confusing because this is a three-dimensional deformity with each vertebra occupying a different position in space relative to its neighbour. Interpretation of the level of transverse scans is sometimes difficult. Careful use of scout films with all the levels marked is always necessary. Scans must cover the whole area, certainly from one pedicle to the next in degenerative disease. Stacked continuous slices are useful for reconstruction.

CT/myelography

There is no doubt that, at the present time, the combination of CT scanning with intrathecal contrast medium provides the best single investigational technique for spinal problems. The slight additional morbidity is more than balanced by the additional information gained in cases where the neurological function is compromised. This is therefore the principal method of investigation for more complex cases.

MRI

The beauty of the pictures tends to distract one from the fact that bone is not always well imaged. MRI is the investigation of first choice for myelopathy but not (yet) for problems primarily involving bone. It may be that with stronger magnets, improved coils and better software MRI will replace most other investigations. At present the average CT scanner is better than the average MR imager for disc prolapses in the lumbar region, though a certain amount depends on the experience and availability of radiologists and the time available for special sequences. However much of disc pathology at every level is associated with bony changes and I doubt that CT will be displaced in this field for many years.

Discography

In equivocal cases, especially in young people with pain as the primary problem, cervical or lumbar discography can be helpful in localizing the level from which the symptoms arise. This is mainly by reproducing the patient's pain and not by visualizing the escaping dye from the disc space, as many innocent discs may have undergone degeneration as age advances. Additional CT of symptomatic levels can show more clearly the position of escaping dye which may help in planning the operation.

Isotope scanning

This may be indicated in cases where multifocal pathology, such as tumour or infection, is a possibility. Early isotope scanning may save a lot of time in localization and should be used for any atypical spinal pain. It is particularly useful in children with or without a mild scoliosis to exclude unifocal pathology in the form of an osteoid osteoma or osteoblastoma.

SPINAL STABILITY

Concern about postoperative spinal stability varies greatly depending on the practice, inclination and experience of individual surgeons. Responses range from extensive prophylactic fusions to almost total disregard for instability. A few simplistic comments about stability are appropriate.

A normal spine is very seldom destabilized unless two of the three anterior, middle and posterior elements are compromised (Fig. 1.2). A spine affected by trauma, deformity or local muscular paralysis is very vulnerable and so prophylactic fusion should be considered.

As a preventive measure the facets should be preserved if at all possible in posterior approaches and all extensive spinal operations should be monitored indefinitely for progressive deformity. Potential instability should be excluded by plain or videoscopic flexion/extension studies preoperatively.

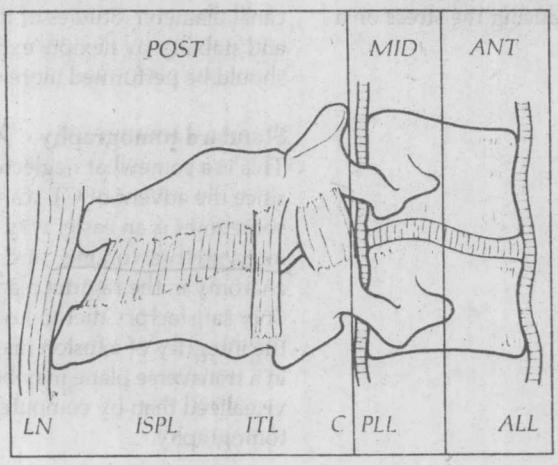

Fig. 1.2

Diagrammatic representation of the spine showing the anterior and posterior columns necessary for stability (after Denis 1983). The spine is divided into anterior, middle and posterior sections.
LN ligamentum nuchae
ISPL interspinous ligament
ITL intertransverse ligament
C capsule of facet joint
PLL posterior longitudinal ligament
ALL anterior longitudinal ligament.