Spinal surgery

Spinal surgery has become a specialty in its own right and the problem is what to leave out of an editorial rather than what to include. Balance and perspective are necessary to illustrate both strategic changes in direction and some of the specific examples of changes in practice. I will address spinal surgery in general and also highlight some of the major changes in operating techniques that have occurred over the last two decades.

It used to be said that neurosurgeons sacrificed bone to preserve neural tissue and orthopaedic surgeons practised the reverse. Fortunately those days are drawing rapidly to a close. There is no doubt that we can all learn from colleagues in other specialties and adapt or adopt some of their techniques to our own requirements. This has been prominent in the evolution of spinal surgery in the 1980s with pooling of neurosurgical and orthopaedic resources directed at spinal pathology. Spinal meetings and conferences, once the preserve of orthopaedic surgeons, now also host neurosurgeons at national and international events. The vertebral column and spinal cord are closely interdependent and mutually reliant for normal development and function. Thus spinal dysraphism or an intramedullary tumour may present as a vertebral deformity and may be first seen at an orthopaedic clinic.

The vertebral column is more important in its relation to the neuraxis than the cranium, largely because the spine has many joints, it moves and is subject to a variety of axial, rotary and other loads and stresses. One might argue that a laminectomy to remove an intramedullary tumour is entirely within the province of a neurosurgeon, and pragmatically this is the case at present. Nevertheless, there is an orthopaedic aspect because spinal deformities may develop in young children following extensive laminectomy. It is not satisfactory to perform intricate surgery but create late complications for someone else to inherit. Currently both the neurosurgical spine surgeon and the orthopaedic spinal surgeon should be involved in the management of such a case. Perhaps in the future the two may be replaced by a single spinal specialist with the combined skills of both.

The “spinal specialist” might result from a separate training programme in spinal surgery. This was advocated in the opening address of the European Cervical Spine Research Society Meeting in Marseilles in 1988. Personally, I do not see this as the way forward, but rather a period of attachment to the other discipline for the neurosurgical or orthopaedic senior registrar who wishes to develop into a spinal specialist.

The remit of a spinal surgeon extends from the top of the clivus (although this is strictly speaking base of skull territory rather than spinal territory) to the coccyx and he or she will be familiar with all the approaches to the bone structure and neuraxis between. These may be anterior, posterior or lateral. One of the attractions of spinal surgery is that it requires a knowledge and surgical capability in almost every compartment of the body. Transfacial or transpharyngeal access to the odontoid-foramen magnum-clivus region, thoracotomy, retroperitoneal lumbar exposures and direct visualisation of the greater sciatic notch during excision of the sacrum illustrate this point. Most neurosurgeons are familiar with the surgical management of spinal degenerative disease, metastatic tumours and benign tumours of the spinal cord and meninges, but are less familiar with primary vertebral bone tumours, chordomas, intramedullary tumours, vertebral osteomyelitis, tuberculosis etc. I would assert that these more exotic forms of spinal disease should be treated by a spinal specialist. Sub-specialisation is easier in a regional neurosurgical unit where the concentration of skill will be beneficial to the patient, to surgeons in training and for progress in spinal surgery in general. Conversely, operating within the relatively large retro-peritoneal compartment or the chest cavity or drilling out the lower third of the clivus develops skills, dexterity and experience which differ from those required for microsurgery within the cranium; the spinal specialist in neurosurgery must ask himself whether this discipline has diverted him away from intracranial microvascular surgery or surgery of eighth nerve tumours.

Lumbar disc disease is perhaps the most common reason for operating on the spine. In common medical and nursing parlance, patients still have a “laminectomy” for a prolapsed lumbar intervertebral disc. In fact laminectomy is rarely carried out except for re-explorations or occasionally difficult central disc prolapse with cauda equina compression. The disc material can quite adequately, safely and satisfactorily be removed via a unilateral or bilateral fenestration through ligamentum flavum with little or no bone removal.

Over the last 20 years the surgical opening through which a lumbar disc is removed has decreased in size. In the 1970s Williams1 in the USA and Caspar2 in Europe prompted microsurgical lumbar disc removal, now generally referred to as “microdiscectomy”. This involves a four centimetre incision through which, using the operating microscope, the prolapsed disc material is removed. The idea is that the smaller incision produces less damage to surrounding soft tissue structures leading to less post operative pain and discomfort.3 4 This procedure can be used as an outpatient operation.5 6 The concept of microdiscectomy has certainly gained favour although Williams’s idea of removing solely the prolapsed piece of disc material has not been widely accepted. Microdiscectomy is aesthetically more pleasing for both patient and surgeon, results in less time spent in hospital, and success rates in excess of 90% are reported.4

Chemonucleolysis is a percutaneous technique carried out under local anaesthetic by which chymopapain is...
injected into the disc space. It was first introduced in 1964 and since that time there has been considerable debate about its place in the management of prolapsed discs. The distillation of a number of clinical trials, both controlled and uncontrolled, is that the technique has a success rate of around 70% in the short-term. The selection criteria for chemonucleolysis are more restricted than those for surgical treatment, excluding patients with any suggestion of sequestered disc material or root canal stenosis.

Recently Van Alphen et al compared surgical disc removal with chymopapain injection. They found that at one year 25% of those patients who had injection required open disc surgery and only 44% of these latter were successful. In the long term there was not a significant difference between chymopapain and surgical disc removal although the former patients had a more complicated management course. Weber found that in the very long term conservative management or no specific treatment almost always led to an improvement at five to ten years.

In the short term, microdiscectomy produces better results more quickly and reliably than either chymopapain or conservative management. Careful selection of patients for surgery remains imperative and Waddell has done great service to the treatment of lumbar disc disease and lumbar spinal pain by identifying non-organic physical signs and other psychological problems.

The latest technique of lumbar disc removal is also percutaneous, but employs mechanical removal of disc material, again avoiding general anaesthesia. The mechanical nuclease or automated percutaneous discectomy has the same selection restrictions as chemonucleolysis. Pooled data suggest a success rate of between 75–80% in selected cases, which is also less than that which can be achieved through open surgical technique. Percutaneous discectomy is not primarily directed at the offending portion of prolapsed disc causing root compression and this may account for its lower success rate.

The commonest spinal emergency remains spinal cord compression due to metastatic disease, but management of this condition has undergone radical change over the past 10 years. Previously the usual form of spinal cord decompression was by laminectomy, but this did not produce an acceptable rate of success, that is, walking patients. Findlay and others articulated the feeling of gloom associated with laminectomy for metastatic disease by highlighting the very modest success rates achieved and indicating the unacceptably high rates of neurological deterioration and post-operative instability rates when laminectomy was performed on patients with vertebral body disease. The swing towards radiation therapy gained momentum and to a major degree this form of therapy has replaced laminectomy.

The early 1980s saw a move towards vertebral body excision to decompress the ventral surface of the spinal cord compressed by tumour or infection. The vertebral body is the commonest location for metastatic disease in the spine and the thoracic spine is most often affected. Success rates after thoracotomy and vertebrectomy with anterior fusion/fixation are high and better than those achieved through laminectomy. Even paraplegic patients can be made to walk by expeditious vertebrectomy. My own experience with this type of surgery has left me concerned about the definition of paraplegia in early reports, but this slight cynicism must not detract from the undoubtedly benefits that have come from aggressive anterior spinal decompression and fixation for this condition. Success in a patient with metastatic spinal disease is not measured by life extension or preservation, but maintenance or restoration of the ability to walk, preferably up to death.

The decision to undertake a major spinal operation on a patient with metastatic disease must take account of a number of different factors including a) the severity and duration of the neurological deficit, b) the speed of progression, c) the histopathology of the tumour and its sensitivity to radiotherapy, d) the patient's 'tumour burden', e) general fitness and life expectancy and f) the surgical accessibility of the compression. It is difficult if not impossible to produce a contingency plan which covers the range of clinical presentations in this condition with which we are faced, but aided by advanced spinal imaging and if necessary, percutaneous vertebral body biopsy, optimal decompression procedures can be selected for individual patients from an expanded range of operations.

The possibility of an improvement in results is placed in jeopardy by unnecessary delays in referral, as described by Maurice-Williams and Richards. Expedient referral of the patient with impending or early paraparesis to the spinal surgeon ensures a high likelihood of a successful outcome. Nevertheless, surgeons remain depressingly aware of the late referral of paraplegic patients for whom little can be done despite their technical advances.

In 1917 Kanavel reported an operation carried out through the mouth to remove a bullet lodged between the skull base and atlas. Over the following 50 years this transoral route was used intermittently with largely indiferent results for various disorders at the region of the anterior foramen magnum. Opening the dura via this route was especially hazardous due to the incidence of postoperative cerebrospinal fluid leakage and meningitis. It is almost impossible to achieve a watertight closure of the dura by suturing through this limited access.

In the 1960s several authors reported the technique of accessing the upper cervical spine via the transoral route for fractures of the odontoid peg. Since the late 1970s, but especially through the 1980s, the transoral (or transpharyngeal) route to the lower two thirds of the clivus and the upper two or three cervical vertebrae has become almost popular. This is partly because of several technical improvements and advances which took place during that time. The operating microscope of course became a standard piece of neurosurgical equipment in the mid 1970s. Anaesthetic advances secured better operating conditions and appropriate instrumentation evolved. Closure of the dura is now possible using the biological glue—Tisseel (Immuno Ltd, Kent), although this has not yet received full Department of Health approval.

About 50% of transoral surgery is carried out for rheumatoid disease in the atlanto-axial joints. This is present in about 25% of patients with this common condition, but only a small proportion of patients develop a myelopathy. Previously the standard operation for rheumatoid patients with a myelopathy due to atlanto-axial subluxation was a C1/C2 or an occipito-cervical fusion. This produced at best indifferent results. Transoral removal of the odontoid process and surrounding pannus is a safe and better method of surgically treating this condition. It is usually combined with some form of cervical or occipito-cervical fixation. Transoral decompression is used when the spinal cord cannot be decompressed by restoring to the lateral pressure. The patient's tumour load and vertebral body disease. Previously we considered reduction of atlanto-axial subluxation in terms of the position of the atlas and axis. With computerised tomography or magnetic resonance imaging of this region, in flexion and extension, it is clear that even when the vertebral bodies have returned to normal position (usually in extension of the neck) compression of the cervico-medullary region may still be present. Fixation in this position will of course not produce decompression of the neuraxis. Vertical translation of the odontoid process can only be decompressed from the anterior route and we
must now consider "reduction" in terms of medullary or spinal cord compression rather than the restoration of bony elements to their normal alignment.

The transoral and transmaxillary approaches give good access to mid-line tumours such as clivus chordomas or ventral foramen magnum meningiomas. Whether this mid-line extradural route proves to be more effective in the long-term remains to be seen. There is little doubt that the approach is safe and allows a more "complete" removal of the tumour than previous methods such as the middle fossa/transientorial intradural route.39

There are many other examples of technical improvements and advances in spinal surgery and newer methods of metal fixation are presented every year. One of the main themes of the 1980s has been multi-segmental sublaminar wiring. This was derived from "L" shaped rods devised by an orthopaedic surgeon called Luque. The technique provides a very strong form of posterior fixation and its use has been extended to various forms of spinal pathology. The Hartshill rectangle (Hartshill, Surgicraft, United Kingdom) is one of the derivatives of Luque rods and was devised for lumbo-sacral fixation. It is used also in the thoracic and cervical spine to good effect. Sublaminar wiring, however, can be associated with postoperative myelopathy and radiculopathy especially in the cervical and thoracic region although the risk is not yet accurately quantified. Such a powerful and useful technique should not be discarded simply because of an associated risk although this is a potent argument for reserving it for spinal surgeons experienced in the passage of sublaminar wires.

The Brindley-Finetech sacral implantation operation is one of the outstanding technical successes of the decade.35 Restoration of urinary continence to the quadriplegic or paraplegic patient has great physical and psychological benefits. Development of the interface between electronics and neural tissue is still in its embryonic stages, but is one field where increasingly sophisticated software and miniaturization of hardware will lead to new operations to implant meelelectronic devices, especially around the spinal cord. The field of restorative neurosurgery is likely to expand in the next two decades, but in the spinal cord we are already seeing successful, if crude, methods of externally influencing the neuraxis.

This is an exciting time to be involved in spinal surgery, which I hope I have shown to be an evolving, developing and progressive specialty. I look forward to being asked to re-write this editorial in ten years time.

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