As in all other disciplines in orthopaedic surgery, continued scientific developments have added to our understanding of spinal diseases. Development in biomechanics and instrumentations has allowed emergence of new surgical techniques.

**Spinal Fractures**

The treatment of spinal injury, especially the unstable ones like the burst fracture and fracture dislocation, is early stabilisation. This normally includes instrumentation with fusion.

In the thoraco-lumbar spine, one of the recent developments is the vertebroplasty for wedged compression fracture of the thoraco-lumbar spine. Wedged compression fracture of the thoraco-lumbar junction is one of the most common fracture of the spine, especially in older patients with osteoporotic spine. Patients who suffer from anterior wedged compression fracture will need prolonged bed rest and use of orthosis. Further collapse occurs commonly in the course of treatment. In some cases non-union and chronic pain develops.

The principle of vertebroplasty is to correct the deformity by extension and filled the subsequent void in the vertebral body by injection of bone cement. To achieve this, a wide bore canula is introduced percutaneously, through the pedicles under fluoroscopic guidance into the centre of the vertebral body. Bone cement is then injected to fill the space produced after reduction of the wedged compression fracture. When the cement consolidates, it provides support to the cancellous bone in the vertebral body and prevents collapse during healing, thereby preserving vertebral height and prevents the occurrence of kyphosis, which is believed to the cause of chronic pain.

Since bone cement consolidates in an exothermic reaction during which the temperature can reach 70°C, it is obvious that to prevent complications, the cement has to be confined to the vertebral body. Any leakage, either anteriorly into the retroperitoneal space where the great vessels course through or into the vertebral canal can be catastrophic. Therefore, it is imperative to make sure that the fracture is a wedged compression fracture and not a burst fracture by CT scan. The cement has to be rendered more radio-opaque so that it can be visualised more readily in the fluoroscopy.

Research is underway to find a material with the mechanical quality of bone cement and will cure at low temperature so that any accidental extravasation will not cause heat damage of the vital structures like the great vessels and the spinal cord.

Another alternative method based on the same principle is the spondyloplasty. It consists of a balloon introduced via the transpedicle route. The fracture is then reduced by postural method. The balloon is then inflated to compress the adjacent cancellous bone in the vertebral body. The balloon is then removed and bone cement now injected under low pressure. The chance of extravasation should be lower with this procedure.

**Spinal Cord Injury**

Research in spinal cord injury has been progressing slowly. The emphasis of basic science research is on prevention of secondary injury immediately after the cord trauma. At the other end, researches to find computer-assisted orthosis to aid ambulation in paraplegic or tetraplegic are continuing.

**Cervical Spine**

For degenerative changes or disc herniation in the cervical spine, there are no changes in the indication of surgery. Surgery is indicated in persistent neck pain with or without radiculopathy unresponsive to an adequate period of conservative treatment. Patients who suffer from myelopathy will have a higher tendency to require surgery eventually, as myelopathy has a higher tendency to deteriorate. In addition, myelopathy tends to respond less readily to conservative treatment. The principle of surgery in radiculopathy is adequate decompression. For single or two-level compression, the surgery of choice is anterior decompression with fusion. For multiple levels compression, laminoplasty is indicated. Immediate deterioration after surgery is still the most dreaded complications and the pros and cons should be adequately discussed with the patients and their family before surgery.

The standard anterior operation is still the anterior cervical fusion. Available now are implants for spinal fusion. These allow better anchor and fixation. Together with the bone graft substitute, they obviate the use of bone grafting and decrease the morbidity associated with the donor site, which is a not uncommon cause of post-operative morbidity when cortico-cancellous graft is used. There are also cervical plates and these are useful in spinal fractures. However, one must realise that these new
implants do not change the indication of cervical spine surgery.

Because of report in long-term studies of about 25% prevalence of adjacent segment symptoms within ten years in persons with cervical fusion, there has been a move towards disc replacement instead of fusion. Early results seem encouraging. However, whether disc replacement will decrease the prevalence of adjacent segment disease remains unanswered. There is also the potential problem of the wear particles. The effect of trauma following disc replacement is unknown.

Lumbar spine

For herniation of the lumbar disc, there is the development of disectomy surgery by use of endoscope. This is a minimal invasive technique with small incision. The principle of treatment, the indication of operation for a herniated disc remains the same whether one is using the conventional disectomy or the endoscopic method. By using an endoscope, similar visualisation of the disc can be achieved with a smaller incision. The smaller incision decreases the post-operative pain and allows early mobilisation, minimising hospital stay and time off work. The disadvantage of the endoscopic procedure is that there can be a steep learning curve.

As in the cervical spine, disc replacement was also performed. In special centres, the early result is encouraging. Whether it is superior to lumbar fusion in the long-term remains to be seen.

For the spondylolisthesis, there is a tendency for more reduction and circumferential fusion for the high grade ones. For the medium grade ones, the tendency is also towards posterior instrumentation and circumferential fusion. It is believed that these techniques lead to higher rate of fusion and a better outcome. However, neurological risks are higher for the more invasive method.

With our aging population, we are seeing an increasing number of spinal stenosis with spinal claudication. Patients suffering from this condition normally have limited walking distance because of unilateral and bilateral sciatic leg pain. Some will respond to conservative treatment. Those with persistent symptoms with limited walking distance will benefit from decompressive laminectomy with decompression of the lateral recesses. Decision making in the geriatric patients can be difficult and they may suffer from diseases of the cardiovascular system, pulmonary problem and the brain that make them poor surgical risks.

Outcome of Surgery

Recent studies have again placed emphasis on pre-operative mental scores as a predictor of outcome in spinal surgery.

A ten-year study from twin City spine centre reported a ten years follow-up study of 178 patients with lumbar spinal fusion. The overall satisfaction at ten year is 70%. 17% had had adjacent surgery. The result is quite close to a local study done about twenty years ago but this study has a larger sample size. Fusion extension was required for 21% of the patients in whom the initial operation was a posterior spinal fusion, compared with 16% for combined anterior and posterior fusion. It was found that adjacent level extension of fusion was more commonly required when the initial fusion had been to the sacrum and when decompression also had been done.

Biological Research

Biological research on BMP and its role on spinal fusion are still ongoing. Although there have been encouraging results, it is still too early for large-scale application in clinical settings.

There are various studies on biological treatment of disc degeneration by biological method. There was a study in the HKU on transplantation of fresh frozen allograft of intervertebral disc. The investigator reported survival of the allograft and some metabolism, but they also noticed severe degeneration by twenty-four month. If the transplantation could be combined with a blocker of disc degeneration, this could be an effective strategy for the treatment of severe degenerative discs. Various humoral agents and gene therapy as blockers of degeneration are under research.

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