
CLINICAL ARTICLE

An approach to failed lumbar surgery

Prof JA Shipley, MMed(Orth)
Department Orthopaedic Surgery, University of the Free State, Bloemfontein

Reprint requests:
Prof JA Shipley
Department Orthopaedic Surgery
University of the Free State
Bloemfontein
Tel: (051) 405-2242
Fax: (051) 430-7101
legraner@fshealth.gov.za

Abstract

With the rising rate of spinal surgery, the need to manage cases of failed operations is on the increase. A systematic approach is essential to identify the causes of persistent or recurrent symptoms, and the first step is a detailed and thorough history and examination. MRI is often the most valuable special investigation. Further surgery is only justified when clinical findings are consistent with significant radiological pathology which can be treated surgically with a probability of success and little risk.

Introduction

Spinal operations for pain can be successful. However, 10-15% will fail, and it is these cases that are responsible for the poor reputation and much of the cost of spinal surgery.

To put things in perspective, 10% or more of hip or knee arthroplasty cases also continue to have pain in the treated joint, suggesting that there are undefined factors influencing our orthopaedic outcomes when pain is the reason for surgery.

As in arthroplasty surgery, the first spinal operation is the important one. Re-operation for failed spinal surgery has only a 50% success rate, and this drops to about 25% for a third operation. More important, after a third attempt, the risk of worsening the patient's condition exceeds the chance of improvement, and this negative risk:benefit relationship deteriorates with further operations.

This article summarises my personal experience of this difficult problem.

Approach

In broad terms failure can be caused by:^{1,2}

- incorrect patient assessment
- inadequate or inappropriate surgery
- peri-operative complications
- new pathology

After evaluating the patient, the surgeon must have answers to the following questions:

1. Was the original diagnosis correct?
2. Was the original operation justified?
3. Did the patient have realistic expectations of the operation?
4. Is patient satisfaction influenced by secondary gain – financial or social?
5. Did the operation achieve its purpose – if only temporarily? If not, why not?
6. Were there any peri-operative problems that could cause an unsatisfactory result?
7. Was there any alteration in symptoms following surgery, suggesting new pathology developed after surgery?

Was the original diagnosis correct?

The key to solving these problems is often the history.

The patient should be questioned about his pre-operative symptoms as if the operation had never been performed, to gain an accurate impression of the patient's status before surgery. This includes a full systemic history including the effects of treatment. This should be followed by an equally painstaking examination. The surgeon needs to clarify the nature of the patient's problem, whether it is back or leg pain, or a neurological deficit, as this will direct investigation and management.

An attempt should be made to exclude other sources of pain which may have become more obvious after the passage of time. Common problems are hip disease (often coexisting with spine pathology), trochanteric bursitis, meralgia paraesthetica, as well as sacro-iliac and pelvic pathology. Arterial insufficiency and diabetic and other types of neuropathy must be considered where significant limb pain or neurology persists. Abdominal pathology such as aortic aneurysm, perforating peptic ulcer, pancreatic tumours and pancreatitis, and urinary tract pathology are serious causes of referred back pain that must be excluded.

Review all special investigations that are available, and collate all clinical and radiological information to decide what your own diagnosis would have been if you had been the primary surgeon.

Was the original operation justified?

Were the expectations realistic?

With this working diagnosis a decision can be made as to whether the surgery was justified, not only on the grounds of the diagnosis, but also considering the severity and duration of the patient's symptoms, and whether an adequate trial of conservative treatment was attempted. Accepted indications for surgery should be applied; the greater the deviation from these standards, the greater the risk of an inappropriate procedure. It is important to avoid compounding a previous surgeon's error of judgement by continuing to treat a non-surgical problem with a further operation.

The patient should also be asked about his expectations after the operation, and whether there is any question of compensation. When talking to the patient, be aware of any suggestion of unhappiness with the previous surgeon (often as simple as poor communication) which may have led to dissatisfaction with the results of the operation. If so take extra care to explain matters, especially the treatment options and the factors complicating decision-making, and avoid any criticism of the previous surgeon unless there are very good grounds.

Did the operation achieve its purpose?

If the patient's symptoms were unchanged after surgery, either the diagnosis was incorrect, the pathology was not amenable to surgery, or the operation was performed incorrectly. Some patients will say the symptoms recurred after a week or two, and it can be presumed that a period of rest and analgesia after the operation is responsible for the improvement, rather than the operation itself.

History, examination and radiology should help decide which of the above is most likely.

The commonest surgical errors encountered are wrong level and wrong side surgery, as well as inadequate root decompression (usually foraminal), and unrecognised instability. Wrong site surgery is often visible on plain X-rays. Most surgeons can count, but they may be confused by anatomical variations such as segmentation anomalies.

Careful comparison of the pathological level on MRI and X-rays is essential to avoid mistakes. Surgery should not be performed without these images being available in theatre, and the level of operation should always be checked by intra-operative X-rays.

Inadequate decompression may be detected clinically by persistent neurology, but often requires MRI or CT-myelography (especially in the presence of steel implants or deformity). It is advisable to position a patient in lordosis during laminectomy, and ensure that the decompression is adequate in this position of maximum stenosis. Extraforaminal nerve root compression by a disc, osteophytes or of the L5 root between the L5 transverse process and the sacral ala should be considered and excluded.³ Instability is best demonstrated by flexion/extension views.

When did new symptoms appear?

If the original symptoms were relieved, but replaced by a new pain or neurological deficit, the timing of their development is critical.

Immediately after surgery

If the symptoms were present immediately after surgery, probably some intra-operative problem occurred.

Traction or direct injury to nerve roots must be considered, the so-called "battered root syndrome". This may be permanent, partly or completely reversible, but not necessarily painful. In the absence of persistent compression, surgery is unlikely to improve the outcome.

A dural tear may have allowed herniation and damage to nerve roots, or CSF leakage with formation of an arachnoid cyst.

Nerve compression by misplaced pedicle screws, cages or disc prostheses should have been noted intra- or post-operatively, and the necessary adjustments made. The diagnosis is usually easy on plain X-rays, but sometimes CT is necessary.

A few days after operation

A short delay, up to a few days, before developing neurological deficit in a patient who was initially intact after surgery, is most suggestive of an extradural haematoma. There is often a history of marked wound pain, and some oozing, but not necessarily unusual swelling or drainage of blood into the suction drain. This is an emergency and the wound should be opened in theatre without delay if it is suspected. Imaging is a waste of time as no other condition is likely to be responsible (unlike in the cervical spine where cord oedema may mimic a haematoma clinically), and nothing is lost if no haematoma is found.

Onset of back and leg pain a few days to weeks after surgery often occurs with infection – either a discitis or an epidural abscess. There is usually a history of fever, wound drainage and delayed wound healing. The pain usually persists and increases with time.

Examination usually shows a rigid, very tender and protected spine, with signs of nerve irritation, and sometimes a nerve deficit. Infection may be confirmed by inflammatory blood markers (ESR, C-reactive protein [CRP]). Changes in the white cell count are much less sensitive, as these are often low grade infections. Plain X-rays may show the disc narrowing, vertebral sclerosis and end plate destruction of discitis. MRI is the investigation of choice as it is sensitive for even early infections, and will also show other potentially significant pathology such as extradural fluid collections, disc herniation etc., unlike an isotope bone scan.

A few months after operation

Leg pain and radiculopathy developing some months after operation and gradually increasing, suggests epidural fibrosis or arachnoiditis. This postoperative scarring is less likely to cause isolated back pain. This type of pain usually reaches a plateau after a period of some months to a year.

Non-union of a fusion usually becomes symptomatic 3–6 months after surgery, but may cause surprisingly few complaints. Pain is typically related to movement, and may be accompanied by a palpable or audible click, especially where instrumentation has failed. Loosening of instrumentation is usually more painful than breakage of rods or screws.

Loosening of screws shows as a halo developing round the shaft of the screw; this may also be a sign of infection.

Straight X-rays are not very sensitive for a pseudarthrosis. Radiological instrumentation failure is an excellent marker for non-union; unfortunately the presence of instrumentation may obscure the fusion mass, and a possible pseudarthrosis. Oblique views often show the fusion mass better than P-A views, especially in the presence of internal fixation.

Flexion/extension views have their advocates, but it is difficult to take comparable views in two positions, the measurement error is high (only $>6^\circ$ difference is significant), and internal fixation will usually prevent this amount of movement. These views are mostly of value in uninstrumented fusions.

Screw or rod breakage, especially if delayed, is not necessarily a sign of non-union. If the instrumentation was under stress at the time of insertion, it may snap due to fatigue despite union. Even if a pseudarthrosis is present, it may progress to healing after failure of fixation.

Onset of symptoms after a period of good relief

If symptoms improve for 6 months or more and then recur, they are probably due to new pathology, either at the same or a different level. If symptoms are similar or identical, probably the previously operated level is to blame, the potential causes being a facet fracture at the laminectomy site, a recurrent disc herniation or a facet cyst. A disc that was apparently healthy before surgery may collapse causing stenosis or instability in less than a year.

Disc herniation at a different level may occur, probably causing leg symptoms in a different distribution and new neurology in comparison to findings before the previous operation.

Recurrent stenosis may occur due to bony overgrowth or progressive instability at the site of a previous laminectomy, or at an adjacent level. The latter may be more common above a previous fusion.

Late infection may occur in immune-compromised patients, such as diabetics, and should always be excluded.

The crucial investigation in this group of patients is MRI, with contrast enhancement. This allows the differentiation of avascular disc material from postoperative fibrosis as well as showing most types of new pathology.

Failed rehabilitation

Many patients never achieve the full benefit of surgery because they are not adequately rehabilitated. Much poorly defined back and leg pain is caused by tight muscles, soft tissue scarring, tethered nerve roots etc., and these are often improved by a good rehabilitation programme.

Diagnostic work-up

The value of many investigations for different conditions has been discussed above.

The following investigations should be performed routinely:

- full blood count, ESR, CRP for infections and possible haematological disease
- basic bone biochemistry (Ca^{++} , Pi, ALP) for metabolic bone disease
- plain X-rays of the spine (with oblique and flexion/extension views), pelvis and hips

Investigations

The following investigations may be considered according to circumstances:

- MRI is usually the next investigation of choice, as it is so versatile, but is specifically indicated where there is a possibility of nerve compression, fibrosis, disc herniation, stenosis or infection. If instrumentation interferes with the images, CT-myelography is still very useful to show nerve compression, and can demonstrate dynamic stenosis or instability.
- Isotope bone scans are non-specific, but may localise pathology such as pseudarthrosis, facet degeneration or infection in a problem patient. They are seldom cost-effective as a routine procedure.
- Spine surgeons are divided into those who are enthusiastic about discography, and those who consider it of little value. My reading of the present literature is that discography is seldom decisive in the problem case, which is precisely where the surgeon most needs help from the investigation.⁴ Respected colleagues may differ.

- Diagnostic nerve root or peripheral nerve blocks help to localise the source of a radicular type of pain, and may also be of therapeutic value.
 - Nerve conduction studies may be indicated if there is a possibility of a peripheral nerve compression syndrome.
- In cases of intra-operative nerve injury, EMG may show recovery is taking place, and that surgery is unnecessary even if there is radiological evidence of residual compression.

Management

Broadly speaking, patients can be divided into:

- those with demonstrable pathology, consistent with the clinical problem and amenable to surgery, and
- the rest.

Only the first group are candidates for surgery.

A minority of patients have an obvious problem of such severity that the decision for further surgery is straightforward. A word of caution is necessary. Even if the patient has an obvious problem such as loose pedicle screws with a pseudarthrosis, a technically successful revision operation may still be a "failure" if the original indication for surgery was incorrect. All the second operation has achieved is what the first operation was intended to do, and if the first operation would not have helped, then nor will the second.

At the other end of the spectrum are the patients with no significant clinical or radiological signs to explain their symptoms; they have a pain problem not an organic spinal problem, and they belong in the pain clinic not in the back clinic where further surgery may be offered out of desperation. These cases should be thoroughly evaluated, with all appropriate investigations, once their situation is discussed sympathetically with them, and a realistic prognosis given. Many people are ignorant of their problem and are scared to be active because they believe the resulting back pain means that they are causing more damage. If they can be taught to divorce pain from function, and are reassured that if they remain active they will not end up paralysed in a wheelchair, unable to work and support their family, they are often able to adapt to their limitations. A multi-disciplinary approach to these patients is important as it shifts the responsibility for "curing" or "fixing" the patient from a single surgeon to one of support by a group, with the goals of the patient being learning to cope and take responsibility for himself.

Somewhere in-between is the difficult group of patients with marginal indications for operation. These patients should initially have intensive rehabilitation, together with pain control at a pain clinic. They should then be followed to establish the pattern of their pain, which often fluctuates. It is a mistake to follow them up "prn" as then they will be seen only when their symptoms are severe and they seek help, whereas if given a fixed appointment, they will also be seen during their good times, and a more realistic appraisal of their average level of symptoms is possible. This allows for more objective decision-making, as well as a degree of moral support.

Some specific problems deserve comment.

- Epidural fibrosis is a normal event after laminectomy. The association between pain and fibrosis is unclear,⁵ and the various measures used to reduce the amount of postoperative fibrosis have not reduced the clinical problem to any convincing extent. The condition is only temporarily improved by surgical neurolysis, and symptoms usually recur after some months as fibrous tissue forms again. The risk of dural laceration or nerve root injury during this surgery is high.

Broadly speaking, patients can be divided into those with demonstrable pathology, consistent with the clinical problem and amenable to surgery, and the rest

- Pain usually stabilises after a time, and no further deterioration occurs.⁶ Conservative management with epidural or nerve root steroid injections, gabapentin or similar medication and analgesics, together with a nerve mobilisation exercise programme is often all that should be done. Fusion of the affected motion segment may reduce stretching of an anchored nerve root during spinal motion, and may be considered if that level is mobile or unstable.
- A pseudarthrosis usually occurs at a highly stressed level, often L5/S1, where instrumentation is unable to stabilise the motion segment during healing of the bone graft. Fixation by S1 pedicle screws often loosens, and re-instrumentation is difficult. In this situation, additional fixation into S2 or by Galveston type screws into the ilium should be considered, with a PLIF or TLIF anterior fusion to increase stability and the chance of successful fusion.
- A septic pseudarthrosis is a relatively common problem. The risk of recurrent infection after revision of a posterior fusion with bone graft is high. If this is performed, only cancellous autograft should be used, possibly mixed with an antibiotic-impregnated bone graft substitute, and the pseudarthrosis should be stabilised with instrumentation. A better option may be an anterior interbody fusion, as this appears to be less susceptible to infection than a posterior fusion, and the approach is through uncontaminated tissue.
- Revision surgery is difficult. It is best performed by a team of an orthopaedic surgeon and a neurosurgeon, whose skills and experience complement each other. When something goes wrong, as it probably will, it is reassuring to share the stress of surgery and difficult decisions with a trusted colleague.

Summary

No back exists that cannot be made worse by injudicious surgery.

The laws of diminishing returns and increasing morbidity apply to revision surgery.

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A detailed history and examination are the keys to assessment.

Chronology of the complaints is crucial to diagnosis:

- symptoms unchanged after surgery suggests pathology was not addressed
- symptoms worse, or new neurology immediately after operation, suggest an intra-operative problem
- early postoperative symptoms suggest a complication
- late onset of symptoms suggests fibrosis, progressive, recurrent or new pathology.

Demonstration of significant pathology that correlates with the clinical findings is the only reliable indication for revision.

If the original symptoms did not warrant operation, or the expectations were unrealistic, it is unlikely that any further procedure is worthwhile.

Do not criticise the previous surgeon until you have all the facts, and there is good evidence of unprofessional behaviour, even if you disagree with his management.

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