SPINAL INSTRUMENTATION FOR PRIMARY PYOGENIC INFECTION REPORT OF 31 PATIENTS

A. A. FARAJ, J. K. WEBB

The role of spinal instrumentation in the presence of infection is still controversial. Radical debridements of infected vertebrae and disc material and bone grafting usually leaves the spine unstable without some surgical stabilisation.

We reviewed 31 cases of primary pyogenic spinal infection treated by radical debridement, bone grafting and posterior (30) or anterior (1) spinal instrumentation. The indication for surgery was the failure of conservative treatment (8), progressive neurological deficit (19) or the lack of diagnosis (3).

The clinical, laboratory and radiological parameters were assessed pre and postoperatively. The mean period of follow-up was 3.8 years (1-12 years). The neurological deficit was progressive in 19 patients, following surgery all these patients were improved. The neurological deficit was established in one patient ; following surgery, his neurological deficit did not improve. The infection was eradicated in all our patients.

The following complications were encountered : (1) three patients developed deep wound infection, which responded to repeated debridement ; (2) one death resulted from nosocomial septicaemia, (3) reoperation was carried out on one patient for implant failure and on another for a dislodged anterior bone graft.

We conclude that spinal instrumentation may be indicated when after radical debridement of infected vertebrae and disc material and bone grafting the stability of the spine is still compromised. According to the location of the infection and the availability of suitable implants, anterior or posterior instrumentation may be necessary. With appropriate antimicrobial agents, the outcome has been satisfactory in our patients.

Keywords : spinal infection ; instrumentation ; outcome.

Mots-clés : infection rachidienne ; instrumentation ; résultat.

INTRODUCTION

Spinal instrumentation has become an integral part of the armamentarium of spinal surgery. The use of instrumentation to treat spinal infection is however still debatable (1-13). Reports on the use of implants for infections in the appendicular skeleton are generally cautious (2, 5). Infected open fractures of the upper extremities in the presence of skeletal fixation have been successfully controlled by proper debridement, skeletal stabilization following removal of unstable fixation and introduction of effective chemotherapy after identification of the relevant microorganism (5). The role of spinal implants in the treatment of tuberculosis of the spine (8, 13) appears better defined than in non-tuberculous spinal infection (1, 2, 10, 12).

We report a series of 31 patients with pyogenic spinal infection treated by debridement, bone grafting and instrumentation.

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MATERIAL AND METHODS

Of 42 patients, surgical treatment was necessary in 31 Caucasian patients with pyogenic spinal infection. These patients were treated at the Harlow Wood Orthopaedic Hospital, City Hospital of Nottingham and the Centre for Spinal Study and Surgery in Nottingham between 1986 and 1996.

The patients were identified in this retrospective study from the hospital data with discharge diagnosis of primary spinal infection. Data from the operating room reports, microbiology and histology reports were also obtained.

The patients' ages ranged between 18 and 80 years, mean 55.6 years ; 10 were female and 21 were male. Twenty patients were social alcohol drinkers, five were diabetics on oral hypoglycemic drugs and one was an insulin-dependent diabetic. Three patients were on cytotoxic drugs for the treatment of lung cancer (2) or prostatic cancer (1) and three were rheumatoid patients on oral corticosteroids. A history of minor trauma was obtained in 14 patients. The most common associated infections were urinary tract in eight cases, chest infection in one and skin infections in two.

Secondary postoperative and iatrogenic infections were excluded from the study. The results of pre and postoperative laboratory investigations [full blood count, erythrocyte sedimentation rate (ESR), C-reactive protein (CRP), serum electrolytes) and the radiological findings [plain spinal radiographs, myelography, computerized tomography (CT) scan, magnetic resonance imaging (MRI) and radionuclide scanning] were recorded. The gibbous angle of the deformity was measured using lateral spinal xrays. The results of the histopathological study of biopsy, Gram and Ziehl- Neelsen's stain and culture and sensitivity of specimens obtained from the diseased spinal tissue at operation or by needle biopsy and culture and sensitivity studies of blood, sputum and urine were recorded.

It was our microbiology department's policy not to administer antibiotics empirically before obtaining tissue samples or blood sent for culture and sensitivity. In 15 patients the microorganism was identified using needle aspiration ; the blood culture grew the microorganism in 13. The following microorganisms were identified :

Staph.aureus (19), among which one was methicillin resistant, Gram-negative bacteria (8), and *Streptococcus pyogenes* (4).

The operations carried out in all our patients were in one stage. The indications for surgery were :

– The failure to respond to conservative treatment (8 patients). In these patients, preoperative antimicrobial medications were administered for a mean period of 3 weeks (1-6 weeks) without improvement in clinical or laboratory parameters for infection e.g., persistence of sweating and anorexia, high ESR and C-reactive protein.

– The presence of neurological deficits (20 patients) with associated bone destruction.

– In 3 patients the preoperative diagnosis was not clear.

The thoracic spine was involved in 18 patients and the lumbar spine in 13 patients. Our indication for posterior spinal instrumentation (30 cases) using a pedicle screw system was inadequate spinal stabilization despite the largest possible bone graft put across the excised infected bone and disc space. Anterior lumbar spinal plating was necessary for a case of staphylococcal lumbar spinal infection ; in this case the majority of L3 was excised to eradicate the infection and two tricortical iliac bone grafts were put across the defect.

The clinical management and follow-up of all cases of spinal infection was undertaken in conjunction with the microbiology department of the hospital concerned, who gave advice as to the appropriate antibiotics, route of administration and dosage. The postoperative protocol for the treatment of pyogenic infection of the spine was appropriate intravenous antibiotics for two to three weeks, followed by oral antibiotics for 6 to 8 weeks.

The results were assessed in terms of the improvement of the general clinical, radiological and laboratory parameters and the ability to ambulate and go back to work.

RESULTS

Twenty-seven patients could be mobilized with thoracolumbosacral orthosis within 7 days of operation. Three patients were mobilized with walking aids between 7 and 14 days after operation. The mean hospital stay was 4 weeks (range : 3-6 weeks).

The mean period of follow-up was 3.8 years (range 1-12 years). Early in the postoperative period, one patient died following a nosocomial chest infection. Three of our patients had a malignancy (2 of the lung and one of the prostate), they developed early deep postoperative infection which responded to repeated debridment without the need

for the removal of the implants, the wound eventually healed. These patients died within 18 months after the treatment of the vertebral osteomyelitis. The cause of death was the dissemination of the cancer (table I).

Nineteen patients with progressive neurological deficit (Frankel C) had improved two Medical Research Council (MRC) grades (Frankel E) at a 4-6 month follow-up. All working patients (23 patients with a mean age of 46 years, among which five patients were diabetic and 15 of them social alcohol drinkers) returned to their employment at a mean period of 5.7 months (range : 3-8 months). One patient had established neurological compression (Frankel B) of over 4 weeks ; no change was seen in his neurological status following surgery and he remained wheel chair bound.

There was no recurrence of infection at the final follow-up. At the final follow-up, the lateral spinal xray showed a full correction of the gibbous deformity in 29 patients ; two cases of thoracic spinal infection developed recurrent gibbous spinal deformity in the first 3-4 weeks after surgery. This was because of the collapse of the rib bone graft put in the disc space. The gibbous angle was 35 degrees. One case of thoracic spinal pedicle hook and rod implant pulled out proximally ; this needed revision and extension of proximal fixation (fig. 1).

DISCUSSION

Surgical stabilization of the involved segment of the spine helps in controlling the infection by resting the tissues, improves the nursing care and prevents early and late mechanical complications. Both anterior spinal debridement and posterior instrumentation for tuberculous spinal disease have been described for the lumbar and the thoracic regions (8, 12, 13).

The theoretical drawback of internal fixation in the presence of skeletal infection is the introduction of foreign material into an infected area. Experimental studies on the adherence property of *Mycobacterium tuberculosis* to stainless steel (SUS316) have shown that instrumentation of the spine in the presence of tuberculous disease is safe (8). The clinical use of spinal implants is therefore possible, and indeed has transformed the treatment of Pott's disease of the spine. A similar observation has not yet been made for instrumentation of pyogenic spinal infection (8, 12).

We have achieved in this series of pyogenic spinal infection a sound stabilization of the spine using posterior pedicle screw stabilization. This system has the advantage of restoration of spinal alignment without any communication with the infection site, which usually is anterior. Pedicle screw system fixation can safely stabilize the diseased segment of the spine without compromising the motion of the uninvolved segments of spine ; it is therefore superior to rod fixation of the spine. Anterior spinal stabilization was necessary in one of our patients to restore the stability of the spine. The outcome was good with no residual kyphotic deformity at five-year follow-up. Various incidences of complications have been reported in the literature using spinal instrumentation for the treatment of infective and non-infective spinal surgery (1, 10). In a retrospective review of 17 consecutive

Table I. — Complications noted among patients treated surgically for pyogenic spinal infection

Early (3 weeks to 2 months)	Late (2-24 months)	Long-term
i. Graft dislodgement, reexplored (one patient)	i. Failure of posterior instrumentation, the instrumentation was extended proximally (one patient)	i. Degenerative back pain (5 patients)
ii. Nosocomial chest infection in one patient (died)		ii. Established neurological deficit (one patient)
iii. Deep wound infection (3 patients)		iii. Recurrence of spinal deformity (2 patients)

Fig 1. — (a) Postoperative lateral thoracic spine xray showing implant failure following instrumentation for *Escherichia coli* osteomyelitis of T9. The upper thoracic hooks came off the laminae.

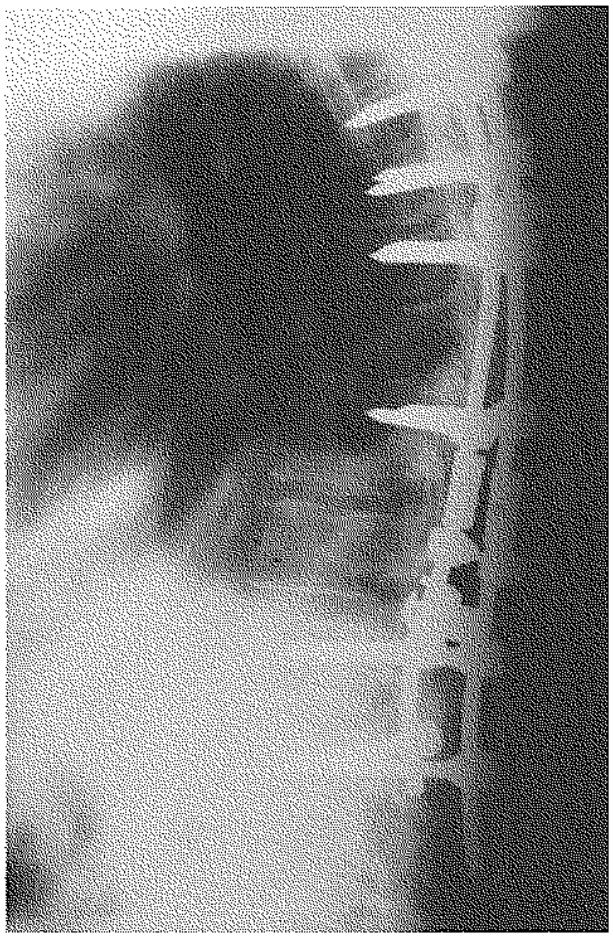

Fig 1. — (b) Post revision xray of the thoracic spine successfully performed using pedicle screw fixation of the upper thoracic spine.

cases of spinal instrumentation for pyogenic osteomyelitis, the infection was controlled in all of them, eight patients however had significant postoperative complications (47%), including two instrumentation failures(1).

In our series, the reoperation rate for implant failure was 2.9% and for postoperative wound infection was 9.3%. The cause of the failure of instrumentation in one of our cases was inadequate proximal hook and pedicle screw fixation of the thoracic spine. Pedicle screws are anatomically difficult to insert in the upper and mid thoracic vertebrae, hooks (laminar or pedicle), and hook clamps are used instead for safety reasons. The fixation achieved by hooks are however weaker than with pedicle screws. In this case, two pedicle screws were inserted passed across the infected vertebrae (fig. 1), consequently and because of the poor quality of the pedicle and the vertebra at this level, the screws pulled out. Having learned from this, we advice pedicle screw fixation above and below the infected disc or vertebra(e) avoiding the infected segment. This will also avoid communicating the posterior and the anterior elements of the spine.

In **conclusion** ; according to our results, spinal instrumentation may be indicated to restore spinal integrity following radical debridement of infection followed by bone grafting of vertebral

osteomyelitis. This provides stability, helps soft tissue recovery and improves the control of infection. This protocol of management must be accompanied by appropriate antimicrobial medications to achieve a good outcome.

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SAMENVATTING

A. A. FARAJ, J. K. WEBB. De rol van instrumentatie in de behandeling van primaire pyogene infectie van de wervelkolom.

De plaats van osteosynthesemateriaal van de wervelkolom bij infectie is omstreden. Radicaal debridement en botgreffen laten vaak een instabiele toestand achter. Er werden 31 gevallen teruggezien die na debridement en botgreffen een anterieure (1) of een posterieure (30) instrumentatie ondergingen. De indicatie tot ingreep was falen van de conservatieve behandeling (8), progressief neurologische uitval (20) of gebrek aan diagnose (3).
De klinische, biologische en radiologische parameters werden pre- en postoperatief nagekeken. De gemiddelde follow-up was 3.8 jaar (1-12 jaar). Zeventien van de 20 patiënten met uitval herstelden volledig. De infectie was onder controle in 87% der gevallen. De volgende complicaties werden opgemerkt :
1) diepe wondinfectie bij 3 ;
2) éénmaal overlijden door nosocomiale infectie ;
3) residuele neurologische uitval bij 4 patiënten ;
4) implant falen éénmalig ;
5) anterieure verplaatsing van een botent ook éénmalig.
De auteurs besluiten dat spinale instrumentatie kan geïndiceerd zijn na radicaal debridement en botenten, wanneer de stabiliteit gecompromiteerd blijft. Anterieure of posterieure instrumentatie kan noodzakelijk zijn afhankelijk van de localisatie en de beschikbaarheid van adequaat implantmateriaal. Met aangepast antibiotherapie is de uitkomst gunstig.

RÉSUMÉ

A. A. FARAJ, J. K. WEBB. La place de l'instrumentation du rachis dans le traitement de l'infection primaire du rachis à germes pyogènes.

La place d'une instrumentation rachidienne en présence d'une infection reste controversée. Après débridement radical des tissus infectés et greffe osseuse, on se retrouve habituellement devant un rachis instable si l'on n'associe pas un geste de stabilisation.
Les auteurs ont revu 31 cas d'infection rachidienne primitive à germes pyogènes, traitée par débridement radical, greffe osseuse et instrumentation rachidienne postérieure (30) ou antérieure (1). Les indications chirurgicales étaient dans 8 cas l'échec du traitement conserva-

teur, dans 19 cas la constatation d'un déficit neurologique évolutif et dans trois cas l'absence de diagnostic. Les variables cliniques, biologiques et radiologiques ont été évaluées avant et après l'opération. Le suivi moyen est de 3,8 années (extrêmes de 1 et 12 ans). Les 19 patients qui présentaient un déficit neurologique progressif ont récupéré totalement après l'intervention. Le patient qui présentait un déficit neurologique établi n'a pas récupéré après l'intervention. L'infection fut éradiquée dans tous les cas. Les auteurs ont relevé les complications suivantes :

1) Trois patients ont développé au niveau de la plaie une infection profonde qui a répondu à un débridement itératif ;
2) Un patient est mort d'une septicémie nosocomiale.
3) Un patient a présenté une défaillance de son montage, imposant une réopération ;
4) Un autre patient a dû être réopéré en raison du déplacement d'une greffe osseuse antérieure.

Les auteurs concluent qu'une instrumentation rachidienne peut être indiquée dans le traitement de l'infection primitive du rachis, lorsqu'il persiste une instabilité rachidienne après débridement radical des tissus infectés et greffe osseuse. Une instrumentation antérieure ou postérieure peut être nécessaire en fonction de la localisation de l'infection et de la disponibilité des implants appropriés. Sous couvert d'un traitement antimicrobien approprié, ils ont ainsi obtenu des résultats satisfaisants chez leurs patients.