Case Report

Use of a latissimus dorsi flap for treatment of infection in a neuropathic shoulder joint

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Study design: Case report.

Objectives: To demonstrate the difficulties that can be encountered in diagnosis and treatment of an infected neuropathic shoulder in a paraplegic man.

Setting: Spinal cord injury center in Germany.

Method: Ultimately, radical debridement and transplantation of a latissimus dorsi muscle flap.

Results: Successful treatment of the infection, partial weight bearing, and limited restriction of range of motion in the affected shoulder.

Conclusion: The latissimus dorsi muscle flap can resolve the infection of a neuropathic shoulder.

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Keywords: neuropathic shoulder; paraplegia infection; latissimus dorsi muscle flap

Introduction

Neuropathic conditions of the shoulder joints are rare. Fewer than 60 cases have been described in the world literature.¹ This condition has borne Charcot's name since he became the first to describe its clinical picture in 1868.² Neurogenic arthropathies of the shoulder joint are mostly associated with cervical syringomyelia,¹ which have an elevated incidence in the presence of post-traumatic deformities of the spinal canal.³ Especially in the early stages of the neuropathic joint destruction, the diagnosis is beset with pitfalls. If the findings in the shoulder are considered in isolation a false diagnosis is possible, such as primary or metastatic malignant tumor, an overuse syndrome or an infection. The situation becomes really difficult when both the differential diagnosis and the diagnosis are correct. So far, two cases of superinfection in a neuropathic shoulder joint have been reported.^{4,5} This is the first report of surgical treatment of a septic shoulder joint also affected by neurogenic arthropathy in a spinal cord-injured patient with syringomyelia.

Case report

In 1971, as the result of a road traffic accident, a 50-year-old man sustained a fracture of T5 with resulting complete sensorimotor paraplegia below T4 and double

incontinence. The fracture healed in such a way as to leave the patient with an obvious kyphosis.

The patient presented in the outpatient clinic with a narcotizing decubitus ulcer measuring 6 cm × 6 cm. On the same occasion, he reported pain in his left shoulder; the pain was related to movement and had been worsening over the last 4 weeks. In addition, he was experiencing increasing pain radiating into both arms and loss of temperature and pain perception in both hands. Clinical examination revealed complete sensorimotor paraplegia below T4, with severe spasticity causing shooting pains, double incontinence, reduced sensitivity to temperature and bathyhypesthesia in the upper extremities right up to the shoulder joint with no segmental differentiation, retained motor action of all segment-indicating muscles in the upper extremities, and reports of pain in the left shoulder on passive abduction beyond 80°. Comparison of both shoulders showed that mobility in the *a-p* plane was greater in the left shoulder than in the right; the sulcus sign was positive on the left, and the left shoulder was slightly swollen.

The *a-p* roentgenogram of the left shoulder revealed typical signs of an incipient neuropathic arthropathy (Figure 1).

The patient was admitted for plastic surgery of the narcotizing sacral decubitus ulcer. In addition, the suspected diagnosis of neuropathic arthropathy of the shoulder was to be worked up in view of the clinical suspicion of cervical syringomyelia. The laboratory tests revealed: Hb 13.9 g/dl, WBC $8.2 \times 10^9/l$, CRP 8 mg/l,

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Figure 1 Rotator cuff arthropathy, irregular borders of the greater tuberosity of the humerus and the lateral humeral surface of the joint, increased sclerosis of the lower surface of the acromion, loose bodies.

temperature 37.0°C. The patient was under the influence of alcohol and in a poor general condition. At 5 days after the patient's admission, the decubitus ulcer was excised. *Proteus mirabilis* and *Escherichia coli* were detected in the ulcer.

The plan was to condition the wound with aseptic irrigating solutions and cover it with a musculocutaneous flap (MCF) from the gluteus maximus muscle. MRT examination of the entire spine and the left shoulder joint was ordered. Since time was short, however, the radiologists only carried out the MRT of the spine. At the transition from the cervical to the thoracic spine, a pronounced syrinx formation was found (Figure 2). At 14 days after admission, the patient developed body temperatures consistent with sepsis, at 40.2°C, severe swelling of the left shoulder accompanied by intense pain, and reddening of the shoulder. The WBC count was $8.0 \times 10^9/l$, C-reactive protein (CRP) 225 mg/l, and Hb 11.0 g/dl. An ultrasound examination of the left shoulder joint showed a definite collection of fluid in the joint, together with irregular echoes from the humeral head.

Figure 2 MR image of the cervical spine and the upper thoracic spine (T1-weighted sagittal view): syrinx beginning at C1, with large cavity from cervical to thoracic.

Pus was aspirated from the shoulder joint. On the same day, the patient was operated on under a general anesthetic using a curved incision for the approach: the deltoid muscle was dissected away from the acromion and the joint was opened up. Approximately 500 ml of pus was evacuated. After irrigation, complete synovectomy and bursectomy of the shoulder joint were carried out. Destruction of the humeral head was already apparent as a depression. The biceps tendon was split and was removed. After the operation, the arm was immobilized in a Gilchrist's bandage. The bacteriological investigation identified *Staphylococcus aureus* in the pus. The patient received cefuroxime, 200 mg i.v. three times daily, for 14 days after the operation.

No raised temperatures were recorded postoperatively. The CRP fell to 50 mg/l. Nonetheless, the wound was weeping copiously. The edge of the wound looked inflamed. There was a danger that the wound would spontaneously reopen. No pathogens were detected on bacteriological investigation of the secretion.

It was decided that a revision operation should be performed and the shoulder defect filled up with a latissimus dorsi muscle flap.

The shoulder wound was reopened with the patient in a lateral position. A cloudy serous secretion was evacuated. The cartilage coverings of the humeral head and of the glenoid, including what was left of the rim, were resected. After this, a skin incision was made over the latissimus dorsi muscle and the anterior edge of the muscle was mobilized. The muscle was dissected away from the lumbosacral fascia and mobilized in the proximal direction as far as the attachment, and the neural and vascular peduncles of the muscle were

Figure 3 The latissimus muscle flap has been mobilized and is lying over the shoulder joint, which is covered by a surgical drape.

revealed. The muscle was then tunneled through under the remaining posterior deltoid section and inserted into the wound cavity (Figures 3 and 4). The deltoid muscle was then refixed and the skin wound closed with two redon drains inserted.

The wound healed without complications, as did that at the donor site where the latissimus dorsi muscle flap had been harvested. The patient received netilmicin, 200 mg three times daily, for 7 days after the operation. This was effective against the *S. aureus* identified earlier and also against *Klebsiella pneumoniae*, which had led to a urinary infection. After 14 days, the patient was mobilized with a CPM shoulder splint, and 6 weeks later the defect caused by the sacral decubitus ulcer was closed with an MCF from the gluteus maximus muscle. On this occasion, the patient was immobilized for 3 weeks after the operation.

With the aim of achieving full weightbearing in the sitting position and regaining the activities of daily living so far as the complete thoracic paraplegia allowed, the patient remained in the Spinal Injury Center for a further 12 weeks for rehabilitation. When he was discharged, he was able to effect transfers, albeit with moderate pain, with the support of an individually

Figure 4 The latissimus dorsi muscle flap is now sited in the shoulder joint following tunneling under the posterior part of the deltoid muscle (1), the acromion (2), the anterior part of the deltoid muscle (3), and the medial part of the deltoid muscle (4).

tailored shoulder orthosis, to start up his wheelchair, and to achieve a functional status in the activities of daily living that made it possible for him to live in his own apartment (Figure 5). The final X-ray examination revealed complete destruction of the shoulder joint

Figure 5 The patient 6 months after the operation, after transfer from the examination couch to a wheelchair; individual shoulder orthosis preventing upward and anterior dislocation of the shoulder.

Figure 6 X-ray picture 6 months after surgery: destruction of socket, bony apposition on remaining part of humeral head, ossification of the acromioclavicular ligament.

(Figure 6). Active abduction of the left shoulder joint was 100° .

Histological investigation of the bony and connective tissue preparations from the shoulder joint showed, briefly, two findings:

- (1) Florid granulating and specific, in part necrotizing, osteomyelitis.
- (2) Brisk reactive bone restructuring with thinned cancellous bone, zones of sclerosis and microcallus formation, and degeneration of the joint cartilage.

Discussion

In the case presented two very rare joint conditions, each of which is very problematic in itself, occurred together:^{1,6} neuropathic shoulder arthropathy and septic arthritis of the shoulder. Nothing is known about the incidence and prevalence of neuropathic shoulder arthropathy in spinal cord-injured patients. Syringomyelia is regarded as one cause.⁷ Wang *et al*⁸ were able to detect syringes in 20% of their tetraplegic patients. Post-traumatic malalignment of the spinal column increase the risk of syrinx development for spinal cord-injured patients.³

The diagnosis was made on the grounds of the clinical history with ascending dissociated impairments of perception going beyond the level of the pre-existing paraplegia, the pathologic hypermobility of the joint with swelling and pain, the joint destruction revealed by the X-ray examination, with free vertebral bodies and signs of incomplete dislocation, and formation of the syrinx seen on the MR images. The history, the findings on clinical examination, and the X-ray findings were suggestive of an early stage of neuropathic arthropathy of the shoulder. Attention has already been drawn to the rapidity of the progressive bone destruction in neuropathic joints.⁷

Extreme caution should be exercised when surgical treatment of neuropathic shoulder joints is considered. Retention of the function is the decisive criterion.¹ Arthrodeses are an accepted contraindication.^{9,10} In the present case, however, the therapeutic procedure was dictated by the onset of an infection. The treatment options available for septic shoulder are aspiration and instillation of antibiotics into the joint plus systemic administration of antibiotics, arthroscopic treatment, operative debridement, and arthrodesis.^{6,11–13}

There are no published comparative studies on the various approaches to treatment. Nord *et al*¹⁴ were not able to detect any significant differences in outcome following various therapeutic and surgical approaches.

Aspiration and systemic antibiotics and the arthroscopic operation favored by Gächter and others for the early stages of infection were not options we considered justified in this case in view of the dramatic clinical situation. The initial radical synovectomy and attempt to preserve the joint certainly led to a temporary improvement in the clinical symptoms, but did not ultimately solve the problem. Even though no microorganisms were demonstrated at the time of the second intervention, the pathological and anatomical examination nonetheless showed that the attempt to preserve the joint after the onset of osteomyelitis had been doomed to failure from the start: it could never have been successful without resection of the cartilaginous areas and the cancellous structures exposed by the neuropathic alterations that had already taken place. The possibility of using the latissimus dorsi muscle flap in the upper extremity¹⁵ and the high antimicrobial potency of muscle flaps¹⁶ meant that a satisfactory result was finally achieved in this case. A latissimus dorsi muscle flap has already been successfully used as an interposed graft in a septic arthropathic shoulder joint in an earlier case.⁵ Our case differs from the earlier one, however, in that we did not perform fixation with a Hoffmann fixator. The application of continuous passive motion led to healing with retained mobility.¹⁷

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