Complex regional pain syndrome complicating total knee arthroplasty

AWR Burns, DA Parker, MRJ Coolican
Sydney Orthopaedic Arthritis and Sports Medicine, Chatswood, New South Wales, Australia

K Rajaratnam
Upper Extremity and Joint Reconstructive Orthopaedics, Hamilton Health Sciences, Ontario, Canada

ABSTRACT

Purpose. To compare the long-term outcome of patients diagnosed with complex regional pain syndrome–type 1 (CRPS-1) after total knee arthroplasty (TKA) with those of uncomplicated TKA knees and preoperative osteoarthritic knees.

Methods. Medical records of 1280 patients who underwent TKA for osteoarthritis were retrospectively reviewed; 8 were diagnosed as having symptoms and signs consistent with CRPS after TKA. Patients with primary inflammatory arthritis, signs of component loosening, malpositioning, or of infected arthroplasty were excluded. No patient had signs of CRPS prior to operative intervention. The 8 patients were compared with 2 groups of age- and sex-matched controls: uncomplicated TKA knees and preoperative osteoarthritic knees. Patients were followed up for a mean of 54 (range, 13–111) months and their range of movement, Western Ontario and McMaster Universities Osteoarthritis Index, SF-36 questionnaire scores, and Knee Society scores were assessed and compared.

Results. After appropriate treatment, most CRPS complicated patients had similar scores on SF-36, Western Ontario and McMaster Universities Osteoarthritis Index, and Knee Society scores when compared with uncomplicated TKA patients. Scores for CRPS complicated patients were significantly improved when compared with preoperative osteoarthritic patients. The incidence of CRPS after TKA was 0.7%.

Conclusion. When managed early, patients complicated with CRPS after TKA have a similar prognosis to patients with uncomplicated TKA.

Keywords: arthroplasty, replacement, knee; complex regional pain syndromes; reflex sympathetic dystrophy

INTRODUCTION

Reflex sympathetic dystrophy (RSD), now known as complex regional pain syndrome–type 1 (CRPS-1), is a condition characterised by disproportionately high levels of pain, abnormal regulation of blood flow and sweating, skin oedema, trophic changes, and joint stiffness.¹ The aetiology of CRPS is not fully understood but involves an exaggeration of physiological responses and is now believed to occur on multiple levels within the central nervous system.² The true incidence of CRPS after total knee arthroplasty (TKA) is unknown as only 72 cases have been reported.³⁻⁷ Diagnostic criteria vary between studies, but an
incidence of 0.8% of all TKA performed has been quoted. Prompt diagnosis and early treatment is most effective in altering the course of the disease, however making a definite diagnosis is difficult as no imaging or diagnostic modalities are specific for CRPS. As a result the diagnosis may be overlooked and lead to increased early morbidity and poorer outcomes.

Little data exist with respect to this pathological entity and no studies document its clinical progression and long-term functional results. Many surgeons consider the outcome of TKA patient with CRPS to be poor as increased pain and stiffness make post-operative rehabilitation more difficult, often creating distress, anxiety, and loss of morale. We aimed to compare the long-term clinical and functional results of patients with TKA knees complicated by CRPS with those of uncomplicated TKA knees and pre-operative osteoarthritic knees.

MATERIALS AND METHODS

Approval was gained from the Ethics Committee of Royal North Shore Hospital prior to the commencement of the study and collection of data. Medical records of all patients from 1991 to 2002 who were operated on by a single surgeon for TKA for osteoarthritis were retrospectively reviewed. Based on the 1280 corresponding records reviewed, 8 patients were diagnosed as having symptoms and signs consistent with CRPS. Patients with marked post-operative stiffness with disproportionately high pain levels, swelling, and/or increased vasomotor and sudomotor changes in the absence of other definable causes were included. Patients with primary inflammatory arthritis, signs of component loosening, malpositioning, or of infected arthroplasty were excluded. No patient had had features of CRPS prior to their operative intervention. For all patients the TKA entailed the Nexgen cruciate retaining prosthesis (Zimmer, Warsaw [IN], USA) inserted via a medial parapatellar approach.

Patients with CRPS after TKA were compared with 2 groups of age- and sex-matched controls. The first group had undergone TKA without complication during the same period and the second consisted of preoperative osteoarthritic patients selected from the current waiting list. Patients’ range of movement (ROM), Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), SF-36 questionnaire scores, and the Knee Society score (KSS) were assessed. All patients had a preoperative diagnosis of osteoarthritis and received routine physiotherapy postoperatively.

Once the diagnosis of CRPS had been established, the patients were treated according to a standard protocol. Formal physiotherapy ceased and the patients were instructed to concentrate on gaining full knee extension but not to force active flexion. Non-steroidal anti-inflammatory medications and oral opioids were commenced as appropriate. In this acute phase the aim was to allow the knee to settle for 2 to 4 weeks, while avoiding development of fixed knee flexion contracture. Formal physiotherapy was then recommenced concentrating on active knee flexion. Failure to progress was managed by admission to hospital for manipulation under anaesthesia with epidural catheter and continuous passive motion. Out-patient physiotherapy was continued and each patient’s progress after discharge was closely monitored.

Results were analysed using non-parametric statistical tests (Wilcoxon signed ranks test).

RESULTS

Findings pertinent to each of the 3 groups (CRPS complicated knees, uncomplicated TKA knees, and preoperative osteoarthritic knees) are summarised in the Table. There was no significant difference between the groups with respect to age, sex, and follow-up period. The minimum length of follow-up for any postoperative patient was 13 months. Although differences in preoperative data between these groups were not statistically significant, the mean value for maximal postoperative flexion was significantly greater in uncomplicated TKA knees than in CRPS complicated knees (114° vs 97°, p<0.001). Manipulation under anaesthesia was required in 50% (4/8) of the CRPS patients and 13% (1/8) of the uncomplicated TKA patients. After the intervention, the mean increase in knee ROM by the 4 patients was 33° (from 64° to 97°), whereas in the single patient with uncomplicated TKA it improved by 74° (from 40° to 114°).

In validated outcome measures, there were statistically significant differences in WOMAC values for both CRPS complicated knees (p=0.04) and uncomplicated TKA knees (p=0.002) when compared to preoperative osteoarthritic knees. SF-36 mental and physical component scores were significantly higher for patients with uncomplicated TKAs than for those with preoperative osteoarthritic knees. Scores for patients with CRPS complicated knees (though similar in magnitude to those with uncomplicated TKA knees) did not reach statistical significance.
when compared with the scores of patients with osteoarthritic knees. When compared to patients with preoperative osteoarthritic knees, KSS were significantly higher (p<0.0001) postoperatively for patients with both CRPS complicated and uncomplicated TKAs.

**DISCUSSION**

CRPS is not a disease, rather a pathological exaggeration of a physiological response, possibly due to misinterpretation and malprocessing of sensory information. CRPS is divided into type 1 (previously RSD) where no identifiable nerve injury is present, and type 2 (previously causalgia) where injury to a particular nerve has occurred. Though previously attributed entirely to autonomic hyperactivity, current scientific evidence suggests much greater complexity affecting multiple levels within the central nervous system.

The incidence of CRPS after TKA is not well appreciated, as the literature has been limited to 72 cases. Early references to CRPS after TKA estimated an incidence of between 0.8 and 1.2%. However a recent study reported that 21% of primary TKA patients fulfilled the criteria for the diagnosis one month after the operation, 13% after 3 months, and 12.7% after 6 months. Evidently there is a wide discrepancy for interpretation of the symptoms and signs necessary to make the diagnosis of CRPS.

Reports on the long-term effects of CRPS after TKA on patient outcome are limited. Many considered the prognosis to be poor with persistent limitation of ROM and continuing pain, giving rise to an unsatisfactory result. There may also be a relationship between CRPS, patella infera, and the development of arthrofibrosis; these entities are best treated early while changes are more easily reversible.

The extent of symptoms and signs required to make a definitive diagnosis of CRPS is unclear. In our study the diagnosis was made on clinical grounds using accepted diagnostic criteria. Patients exhibited greater than expected pain with stiffness and slow progress in the absence of component malposition, infection, or other postoperative complications. Vasomotor and sudomotor changes may be difficult to interpret following TKA, especially in the early postoperative period. As with many medical syndromes, patients rarely present all of the classic diagnostic features and unequivocal diagnosis can be difficult and relies predominantly on clinical signs and symptoms.

No laboratory test is specific for the diagnosis of CRPS. Radiography, nuclear medicine scans, magnetic resonance imaging, nerve conduction studies and thermometry, quantitative sensory testing, quantitative sudomotor axon reflex testing, and laser Doppler flowmetry have all been used in diagnosis, and while many are highly sensitive, none
are specific for CRPS. Some authors feel that the gold standard diagnostic test is sympathetic blockade with an improvement in pain and an associated increase in skin temperature. However, more contemporary insights suggest that although sympathetic blockade may be a useful treatment modality, per se it is not a diagnostic test for CRPS. Treatment usually requires a multimodal approach, including medications (non-steroidal anti-inflammatory drugs, sympathetic antagonists, corticosteroids, anti-depressants), physical and cognitive therapy, and sympathetic blocks.

Our management protocol aimed to perform manipulation under anaesthesia in the quiescent phase of CRPS and avoid noxious sensory inputs that exacerbate symptoms during the acute phase. Avoiding aggressive attempts at gaining flexion and aiming to achieve full extension helps reduce the mechanoreceptor barrage, diminishes pain and improves rehabilitation compliance.

The final ROMs of our CRPS complicated patients were significantly worse than in uncomplicated TKA patients; respective mean maximal degrees of knee flexion achieved being 97° vs 114°. These findings are similar to those of other studies, though with slightly greater ROM (2°–97°) at final follow-up than previously reported.

Analysis of validated outcome measures showed that TKA patients with and without CRPS did not differ with respect to final outcomes, although their mean WOMAC and SF-36 scores were significantly better than for preoperative osteoarthritic patients. Similarly the mean KSS for CRPS complicated and uncomplicated TKA patients did not differ significantly, and for both groups the scores were significantly better than those in the preoperative osteoarthritic group.

Limitations of our study are that it was retrospective and entailed a small sample size (which predisposes to beta error). The largely subjective nature of many of the diagnostic criteria is another limitation. There are few reports on CRPS after TKA and our experience shows that early diagnosis and treatment can lead to successful outcomes.

**CONCLUSION**

Patients with TKA complicated by CRPS demonstrate a slower and more arduous recovery than uncomplicated TKA patients. These patients seem to benefit from manipulation under anaesthesia, though their affected knees have less flexion at final outcome. They are nonetheless better off after TKA than preoperatively. CRPS should be considered early in any TKA patient who demonstrates a slower than expected recovery course with increased pain, as early diagnosis and treatment appears to mitigate against poor results and unsuccessful outcomes.

**ACKNOWLEDGEMENT**

We thank Mr Alan Brnabic for his help in statistical analysis.

**REFERENCES**