Carpal tunnel syndrome is thought of as affecting female patients in their sixth or seventh decades. This article reviews the literature and shows that it has an overall prevalence in males nearly equivalent to women. Males present with milder symptoms but more severe electrophysiological changes. Male gender is not associated with poor outcome but many male patients are involved in heavy manual work activities which is a poor prognostic indicator.

Introduction

Carpal tunnel syndrome (CTS) is a clinical diagnosis made on the basis of a group of symptoms and signs caused by compression of the median nerve within the carpal tunnel. These include pain, sensory disturbance, motor loss and electrophysiological change.¹,² Pain may be felt in the hand, wrist or forearm. Weakness if present may be observed in the abductor pollicis brevis and opponens pollicis. CTS is classified as an industrial disease by the department of Work and Pensions, for which disablement benefit may be claimed, and as it accounts for the majority of upper extremity disorders attributed to the working environment, it represents a high cost to society.³ Many clinicians feel that men with CTS respond less well to treatment.

This review examines the particular issues surrounding male patients, and gender differences with respect to CTS.

Epidemiology

There are little good data on the incidence of CTS in the general population. Most studies have looked at specific industry populations in whom rates of CTS are likely to be higher than the general population.⁴,⁵ One large Swedish population based study demonstrated that women have a significantly higher prevalence of pain, numbness and/or tingling in the median nerve distribution than men.⁶ This observation is supported by recent prospective studies demonstrating that women have significantly greater preoperative symptoms and disability than men using well-validated measures⁷,⁸ but that there are no differences in outcome. When only those with clinically and electrophysiologically confirmed CTS are considered this difference is diminished (Table 1). Beyond retirement age the prevalence in women is 4 times that in men in Atroshi et al.’s⁶ study. It is likely given the multifactorial nature of this syndrome that there is some variation between different populations in the prevalence of CTS.

Anatomy

The carpal tunnel is defined on the volar aspect of the wrist by the flexor retinaculum, which spans between the hamate
and triquetrum on the ulnar side to the scaphoid and trapezium on the radial side. It contains the median nerve and the tendons of flexor pollicis longus, four of flexor digitorum superficialis and four of flexor digitorum profundus. The carpal tunnel is narrowest at a point 2 cm from its proximal edge corresponding to the level of the hook of the hamate.\(^9\) However, the anatomy of the median nerve in the carpal tunnel is variable; a detailed description is provided in the study by Lanz.\(^10\) There is little evidence in the literature to suggest significant gender-specific differences in the anatomy of the carpal tunnel. There are a greater number of case reports pertaining to a variety of muscular anomalies in relation to CTS in men\(^11–24\) than women\(^25–28\) which may imply that this is a more common aetiological factor in males; there is however no scientific evidence to support this.

### Aetiology and pathophysiology

Normal tissue pressures in the upper limb are approximately 8 mmHg. In CTS the resting pressure in the carpal tunnel may be 30 mmHg rising to over 90 mmHg with wrist movement.\(^29,30\) This increase in pressure can either lead to ischaemia or with prolonged pressure to focal demyelination.\(^31–33\)

Common conditions associated with CTS are diabetes, rheumatoid arthritis, osteoarthritis, hypothyroidism and wrist fractures.\(^34\) However, in most cases, the cause of the increased pressure is idiopathic. In Atroshi et al.'s study\(^6\) only obesity (BMI of greater than 25) was shown to be statistically more common in patients with proven CTS. In patients with a work-related cause, Manktelow reported an association with tendonitis or epicondylitis in up to 39% of patients.\(^35\)

### Relationship to work

The relationship between CTS and work is contentious. The prevalence of CTS is higher in patient series where the cohort of patients is from a particular "high risk" industry when compared to population studies.\(^5,36,37\) However, the lack of consistency between studies in the definition of CTS makes it difficult to draw direct comparisons. It can be argued that men are more likely to be affected if there is a relationship between heavy repetitive work or work with vibrating tools and CTS. A review of industrial workers compensation claims for a population of three million in North America revealed that half of those claiming for CTS were men.\(^35\) The majority of claims came from assembly and fabrication workers, food processing and construction but the second largest group of claims came from clerical workers. Longitudinal studies in industry workers indicate that increasing age, female gender, obesity, work posture and vibration associated occupations were associated with an increased risk of CTS.\(^5,38\) However, in one study with 17-year follow-up only greater relative weight and female gender were associated.\(^39\) A literature review investigating the causal relationship between work and CTS concluded that except in the case of work that involves very cold temperatures such as butchery, work is less likely than demographic and disease-related variables to cause CTS.\(^4,39\)

At a histological level Pickering has shown there is no significant association between heavy occupational hand use and tenosynovial thickening in the carpal tunnel.\(^40\)

### Other causes

Anatomical variations that impinge on the carpal tunnel,\(^12,18,41\) metabolic conditions\(^42\) and tumours\(^43\) are all well-described causes of CTS.

### Electrophysiological studies

The need for nerve conduction studies remains controversial.\(^44\) As a diagnostic tool nerve conduction studies can be viewed as an adjunct to clinical history and examination. Nerve conduction studies showed a high correlation with a clinical questionnaire set by Kamath and Stothard\(^45\) who advocate its use as an alternative. There is no evidence to support the use of nerve conduction studies to measure outcome although they may be useful in deciding when to re-operate following failed carpal tunnel decompression.\(^46\)

In a multicentre study from Italy, Padua reported that while men complain less of discomfort due to CTS they tend to have more severe electrophysiological findings.\(^47\)

### Management

**Non-surgical—injectons/splints/behaviour modification**

The use of surgical splints for the management of CTS should not be dismissed. In a randomised control trial of splints versus surgery performed in the Netherlands the success rate was greater in the surgery group, with 90% success at 18 months. However, over a third (37%) of those in the splint arm of the trial had a successful outcome at 18 months and

### Table 1  Gender-specific prevalence in the general population\(^6\).

<table>
<thead>
<tr>
<th>Gender</th>
<th>Pain, numbness and/or tingling in median nerve distribution</th>
<th>Clinically certain CTS</th>
<th>Clinically and electrophysiologically confirmed CTS</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Prevalence % (95% CI)</td>
<td>Prevalence % (95% CI)</td>
<td>Prevalence % (95% CI)</td>
</tr>
<tr>
<td>Male</td>
<td>10.4 (8.6–12.2)</td>
<td>2.8 (1.8–3.8)</td>
<td>2.1 (1.3–3.0)</td>
</tr>
<tr>
<td>Female</td>
<td>17.3 (15.3–19.4)</td>
<td>4.6 (3.5–5.7)</td>
<td>3.0 (2.1–3.9)</td>
</tr>
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</table>
the benefit of surgery was tempered by an increase in complications related to treatment including a painful or hypertrophic scar (61%), wound haematoma or infection (11%), severe pillar pain (2%) and one case of reflex sympathetic dystrophy. Predictors of success of treatment with a splint included a shorter duration of symptoms (<1 year) and milder symptoms at the time of randomisation. Gender was not shown to independently alter outcome.

Similarly, the use of steroid injection in conjunction with wrist splints for 3 weeks is adequate treatment in some patients (11% of a series of 50 patients at a minimum of 6 months follow-up) with greater efficacy in those with symptoms for less than 1 year and those with more mild symptoms. A successful initial response to local steroid injection is a predictor of success following surgical treatment in those whose symptoms recur.

In Gorsche’s study, meat-packers behaviour modification to less intensive duties was shown to be effective in managing the symptoms of patients in whom treatment with splints failed.

**Surgical**

There is no consensus regarding endoscopic versus open carpal tunnel release. Randomised control trials have not demonstrated any improvement in success rate of endoscopic release over open carpal tunnel decompression. A Cochrane review concluded that there was no strong need to replace open carpal tunnel decompression with alternative procedures. Proponents of the endoscopic technique point to a more rapid return to work following this procedure; however, this is at the cost of a higher complication rate, including iatrogenic nerve injury. For male patients of working age, while there is clearly a benefit in enabling them to return to work more rapidly, the authors are not aware of any cost benefit analysis comparing the benefit of more rapid return to work to the greater cost of the procedure, longer operating time and financial cost of the complications of endoscopic release. In our opinion the personal cost to the individual in the event of a complication tends to favour open carpal tunnel decompression.

**Outcomes**

Carpal tunnel decompression generally produces excellent outcomes, with over 80% of patients satisfied. However, while patients may declare satisfaction with the outcome of surgery this does not mean that all symptoms are abolished (only 51% to 63% of patients in reported series have complete relief of symptoms). In Agee’s study, one in four patients still reported pain 6 months after surgery, one in eight reported tingling and one in six numbness. Weakness was reported by a third of patients.

Important complications related to carpal tunnel decompression, open or endoscopic, are in Longstaff’s series scar tenderness 13%, pillar pain 10% and weakness 5%. A prospective study of 97 patients with CTS found no differences in outcome between male and female patients following carpal tunnel decompression. However, Manktelow’s large study concluded that female gender was one of the significant independent predictors of worse clinical outcome when adjusted for age. In the same study the better outcome scores were amongst those who underwent surgery. There is no correlation between preoperative electrophysiological parameters and outcome; nor is the outcome affected by preoperative psychological disturbance.

Men with occupation-related vibration exposure have a poorer outcome with only 60% having relief of their symptoms after surgery. Thirty percent still complained of persistent night time paraesthesia, with persistence of symptoms related to degree of preoperative vibration exposure. An association has been demonstrated between physically strenuous work activities and poorer outcomes, all these cases were involved in workers compensation claims and correlated with their inability to return to work. This link between poor outcome and workers compensation claims has been demonstrated in other studies.

**Return to work**

The majority of men with CTS are of working age. The return to work interval is affected by several factors (social security insurance, workers compensation claims, manual occupation) and ranges from an average of 11 days for non-manual independent sector workers to 72 days for state employed workers compensation claimants (Table 2).

Between 56% found that 67% of workers are able to return to their original jobs. Compared to clerical workers assembly and fabrication workers, food processing workers and mechanics are reported to have poorer clinical and return to work outcomes. From the same study the presence of other symptoms of repetitive strain (tendonitis, epicondylitis) is a negative predictor of return to work. An ongoing workers compensation claim is reported to be a critical predictor of work absence.

**Conclusion**

The majority of men affected by CTS are of working age. Open surgical decompression remains the mainstay of treatment. There is no evidence that male patients will

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Average return to work period after surgery in days.</th>
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<tbody>
<tr>
<td></td>
<td>Manual</td>
</tr>
<tr>
<td>Self-employed</td>
<td>29</td>
</tr>
<tr>
<td>Private sector wage earners</td>
<td>42</td>
</tr>
<tr>
<td>State employed</td>
<td>63</td>
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have a less successful outcome following surgery unless their symptoms are related to the use of vibrating tools or they have an ongoing compensation claim. A third of patients will need to consider modifying working practices or seeking alternative employment, especially if working in heavy manual industry.

References

24. Diao E, Shao F, Liebenberg E, Rempel D, Lotz JC. Carpal tunnel pressure alters median nerve function in a dose-dependent manner: a rabbit model for carpal tunnel syndrome. J Orthop Res 2005;23:218–23.