OBJECTIVE: Surgery to achieve ulnar nerve decompression at the elbow has been performed for nearly 2 centuries. Several methods have been developed, some of which have been abandoned. Historical insight improves understanding of current techniques and provides the basis for the development of new methods. Which treatment method is best is the topic of ongoing debate.

METHODS: The literature was reviewed using the MEDLINE database. Standard textbooks and retrieved articles were checked for missing references. For older articles, the bibliographies of books and theses were consulted. When I was unsuccessful in finding information in standard biographies of authors of milestone publications, I contacted the hospitals or institutions in which these individuals worked or are currently working.

RESULTS: A systematic chronological overview of the surgical treatment of ulnar nerve compression at the elbow is presented, with special attention to people who described a treatment method for the first time.

CONCLUSION: This article is the first in the literature to provide information about and photographs of nearly all of the people who were important in the development of the surgical treatment of compression of the ulnar nerve at the elbow. (Neurosurgery 49:391–400, 2001)

Key words: Cubital tunnel, History, Surgery, Treatment, Ulnar nerve

A
fter carpal tunnel syndrome, ulnar nerve compression at the elbow is the next most frequent compression neuropathy of the upper limb. Several surgical therapies were developed, but some of them have been abandoned. The discussion regarding which treatment option is best remains open (12). This article provides a systematic chronological overview of the history of surgery to relieve ulnar nerve compression at the elbow.

PATIENTS AND METHODS

The literature was reviewed using the MEDLINE database. Standard textbooks and retrieved articles were checked for missing references. For older articles, the bibliographies of books and theses were consulted. When I was unsuccessful in finding information in standard biographies of authors of milestone publications, I contacted the hospitals or institutions in which these individuals worked or are currently working.

1816 to 1897

Henry Earle (33) was the first to report the surgical treatment of ulnar nerve compression at the elbow (Fig. 1). In 1816, he described in Medico-Chirurgical Transactions the case of a 14-year-old girl who had severe pains in the area supplied by the ulnar nerve. The patient’s symptoms were characteristic of ulnar nerve compression. After 3 years of observation and unsuccessful conservative treatment, Earle decided to offer her the only known surgical treatment at that time: sectioning of the nerve. After Earle sectioned the nerve proximal of the cubital tunnel, the girl did not experience any pain but did have complete loss of sensibility in the area supplied by the ulnar nerve, and her little finger remained in a paralyzed state. Earle also noted that within the cubital tunnel, the neurilemma covering the nerve seemed firmer and thicker than usual.

Until the late 1800s, few reports were published with regard to ulnar nerve palsy and especially its surgical treatment. In 1818, Granger (41) described a patient with ulnar palsy after fracture of the medial condyle of the humerus. He advised not surgical treatment but anatomic repositioning and immobilization. Grant Calder (22) called attention in 1833 to the effects of division of the ulnar nerve. He referred to a description of a case reported by Schott in Zeitschrift für Physiologie. This case is very similar to that of Earle: because of neuralgia of the ulnar nerve, the nerve was transected.

Before 1878, no reports of patients with ulnar palsy (13, 32, 70) appeared in the literature, except for the first description
All three of these patients were treated conservatively with
of the elbow, after repeated trauma to the cubital tunnel, and

In the
of luxation of the ulnar nerve (14). For many authors, the
three patients developed ulnar palsy 12½ years after fracture
after unsuccessful treatment of the infected wound. The other
found and excised. The patient died because of septicemia
administered. In the first patient, an ossified ligament was
these patients’ disorders were as different as the treatments
reported four patients with ulnar nerve palsy. The causes of
Academy of Medicine Library).

Figure 1. Henry Earle was
born June 28, 1789, in
London. He was trained by
his father and worked as a
surgeon at Bartholomeus
Hospital in London from
1827 until his death on
January 18, 1838. He
published many scientific
reports, and for some of
them he was rewarded, such
as in 1813, when his treatise
on the diseases and injuries
of nerves was rewarded with
the Jackson Prize of the
College of Surgeons.

Beginning in 1833, he was
professor of anatomy and
surgery at the College of
Surgeons. For several years, he was also president of the
Medical and Surgical Society (48) (courtesy, The New York
Academy of Medicine Library).

of luxation of the ulnar nerve (14). For many authors, the
history of ulnar nerve compression at the elbow starts in 1878.
In the Archives Générales de Médecine, Photinos Panas (Fig. 2)
reported four patients with ulnar nerve palsy. The causes of
these patients’ disorders were as different as the treatments
administered. In the first patient, an ossified ligament was
found and excised. The patient died because of septicemia
after unsuccessful treatment of the infected wound. The other
three patients developed ulnar palsy 12½ years after fracture
of the elbow, after repeated trauma to the cubital tunnel, and
secondary to arthritic changes of the elbow joint, respectively.
All three of these patients were treated conservatively with
good results (73). Conservative treatment included hydrother-
apy, massage, and application of electrical current. At that
time, electrotherapy was a conservative treatment modality
for ulnar palsy that had many supporters (11, 16, 17, 34, 70).
The application of all kinds of ointments and solutions also
was popular (11, 13, 37, 70).

Emile-Paul Fèvre (37) reported a remarkable treatment for
ulnar palsy in 1878. In a comprehensive thesis on ulnar nerve
palsy, he discussed several conservative treatment options, as
well as one surgical intervention: liberation and elongation of
the nerve. At the same time, Marchand (60) described the
technique of elongation of the nerves. In his introduction, he
explained that because of their unfamiliarity with the physi-
ology of the nerves, many surgeons hesitated to operate on a
patient’s central nervous system. Their reluctance explains the
scarcity of reports on the surgical treatment of patients with
compression of the ulnar nerve at the elbow. The technique
of elongation is rather simple: after liberation of the nerve, the
nerve is forcefully lifted out of its bed with a blunt instrument
without disrupting its continuity. In 1869, Billroth (60) had
discovered by coincidence the effectiveness of this method.

The effect of nerve elongation was attributed to a loss of
excitability of the nerve. Elongation of the nerve did not gain
much support and was a treatment option for only a short
time. In 1880, Charvot (23) doubted its effect. Andrea (3)
mentioned in his thesis in 1889 that nerve elongation was not
performed anymore, because the patient’s symptoms re-
curred immediately after the operation. The judgment of
Neugebauer (68, p 507) in 1895 about this procedure was
scathing: “Damit wäre nach unseren heutigen Begriffen des Guten
genug gewesen, in den Jahren aber, welchen diesen Falle entstam-
men, in denen die Dehnung modern war, schloss man der notwen-
digen Lösung noch einige kraftige Züge nach oben und unten an
[According to our current understanding of good surgical
practice rather than what was known at the time these cases
were reported, when nerve elongation was a new procedure,
it would have been appropriate to add some powerful up-
and-down jerking motions to achieve the necessary decom-
pression (author’s translation).]” The elongation of nerves
was granted only a short life and did not play a major role in
the surgical treatment of ulnar palsy.

In the 19th century and at the beginning of the 20th century,
the most frequent causes of ulnar palsy were posttraumatic
(most condyle fractures of the humerus) and arthritic changes
in the elbow joint. Luxation of the ulnar nerve also was
thought to be a separate entity that caused ulnar neuritis.
After its first description by Blattmann (14), a gradually in-
creasing number of reports on this subject were published.
Many publications discussed the cause of luxation of the ulnar
nerve (3, 25, 46, 50, 56, 63, 79, 83, 84, 93, 94). The possibility
of traumatic luxation of the nerve was discussed. Several au-
thors assumed that the luxation was present before the acci-
dent. These patients had increased mobility of the ulnar nerve
that became apparent after the trauma to the nerve (25, 43, 78,
80, 83, 93). At the beginning of the 20th century, however, the
role of luxation was doubted. It was noted that only a few
patients with known ulnar nerve luxation eventually devel-
oped signs and symptoms of neuritis. Furthermore, most of

Figure 2. Photinos Panas
was born January 30, 1832,
at Cephalonia, one of the
Ionic islets of Greece. He
studied in Paris and worked
as a surgeon at several
hospitals in Paris, among
which were Lariboisière and
Hôtel-Dieu. From 1873, he
mainly reported on
ophthalmological matters.
Before that time, he
published several articles on
diverse subjects. In 1877, he
was president of the Société de
Chirurgie, and in 1879, he became professor of
ophthalmology and member of the Académie de Médecine.

On January 6, 1903, he died after a 6-year battle with
progressive muscular atrophy (Aran-Duchenne disease) (29,
47, 53) (reprinted from, De Lapersonne F: Panas. Nekrolog
Klinische Monatsblätter für Augenheilkunde 41:169–173,
1903 [29, p 169], with permission from Ferdinand Enke
Verlag).
these patients had bilateral luxations of the ulnar nerve despite experiencing unilateral symptoms (25, 43, 79, 93). The discussion of the role of luxation of the ulnar nerve remains open today.

Poncet (77) published the first description of the surgical treatment of luxation of the ulnar nerve in 1888. He described a child who experienced luxation of the ulnar nerve for 5 years before receiving a trauma to the elbow. At presentation, the child’s signs and symptoms were characteristic for ulnar palsy. Surgery was then performed, and a displaced nerve was found. Poncet created a sulcus at the original location of the palsy, placed the ulnar nerve in it, and sutured the periosteum over the ulnar nerve to create a roof over the tunnel. The patient’s postoperative course was uneventful. This procedure of creating a new sulcus, which is sometimes performed with a modification, gained acceptance. Good results were also reported for nerves that did not luxate (3–5, 20, 45, 46, 79, 80, 84, 89).

1898 to 1959

The report of Benjamin Farquhar Curtis (27) (Fig. 3) is important in modern surgery for ulnar neuritis. In 1898, he reported for the first time a technique that today is called anterior subcutaneous transposition. A patient had experienced ulnar neuritis after a bilateral condyle fracture. After transposing the ulnar nerve in front of the elbow, the outcome was good. In June 1899, Broca and Mouchet (20) reported that César Roux (1857–1934), from Lausanne, Switzerland, also had performed an anterior subcutaneous transposition of the nerve (38), but the result was poor. Although Broca and Mouchet did not want to judge a procedure with which they had not any experience, they were not at all surprised at the Roux’s patient’s outcome, because the tension of the nerve is high when the forearm is extended. Although Curtis deserved all credit for the first report of the anterior subcutaneous transposition, one may doubt who really performed the procedure first, Curtis or Roux.

In 1912, Albert Mouchet (64, 66) (Fig. 4) claimed to have developed a new method of treating ulnar neuritis—the supracondylar cuneiform osteotomy of the humerus—and to have been the first one to describe it. He had extensively studied the mechanism of ulnar neuritis after elbow fracture. He hypothesized that fracture of the external condyle of the humerus in childhood causes a cubitus valgus that ultimately leads to late appearance of signs and symptoms of ulnar nerve neuritis (64). On the basis of his pathophysiological insights, Mouchet developed the supracondylar cuneiform osteotomy of the humerus. Through a small incision at the medial aspect of the arm, he performed a supracondylar osteotomy of the humerus and removed a wedge-shaped piece of bone to correct the valgus deviation of the elbow. He did not look for the ulnar nerve. After the procedure, the patient’s arm was immobilized in a Velpeau plaster. Six years earlier, Siegfried Peltesohn (74), a resident orthopedic surgery, had already described the same pathophysiology and had mentioned supracondylar osteotomy as one of the surgical options. Although Peltesohn was the first to describe this treatment in combination with ulnar palsy, Mouchet gained all the credit for it. Because Mouchet had good results with this procedure and because the method was very simple, he stated that a supracondylar cuneiform osteotomy was the most logical and indeed the only option for a late ulnar palsy and that there was no place for conservative management (64, 66).

So, at the beginning of the 20th century, four surgical methods for ulnar neuritis were known: decompression of the nerve, creation of a new sulcus, anterior transposition of the nerve, and supracondylar cuneiform osteotomy of the humerus. Very rarely was excision of a neuroma of the ulnar nerve at the cubital tunnel reported in combination with the first three surgical options (1, 49, 86). Excision of a neuroma encountered much resistance, or, as J.B. Murphy (67, pp 370, 373) stated in 1914, “There is just one thing to do—not to take the neuroma out, because it would destroy...”
the function of the nerve from where it is being traumatized to a position of safety.” Although Mouchet made many arguments against the other methods and few arguments could be raised against the method he propagated, the cuneiform supracondylar osteotomy was not adopted widely and did not play an important role in the surgical treatment of ulnar palsy. In many later reports, however, it was still noted as an alternative surgical treatment (15, 24, 28, 39, 42, 44, 59, 62, 69, 75, 81, 82). After the 1950s, the supracondylar osteotomy and the creation of a new sulcus gradually disappeared as surgical options. As stated earlier, few arguments could be raised against the osteotomy, and most authors argued against the creation of a new groove because the nerve was prone to be enveloped by new fibrous scar tissue with recurrence of symptoms. Remarkably, the surgical treatment of ulnar palsy typically was not discussed on the basis of clinical proof, and this is true even today. Most authors merely echoed the positions of a previous author.

According to some authors (1, 2, 26, 42, 58, 85), anterior transposition was the treatment method of choice at the beginning of the 20th century: “Of all the methods, the last [i.e., anterior transposition] has best stood the test of time, and in this country has been the most popular treatment” (62, p 38). The reason for the popularity for this treatment modality is obvious because the repetitive friction and traction during elbow movements (of an often traumatic or arthritic deformed elbow joint) were thought to be very important factors contributing to the development of ulnar neuritis. Therefore, removing the nerve from its natural course into a more relaxed one is a logical treatment (21, 31, 35, 49, 72). Anterior transposition initially was performed subcutaneously (27). One of the most frequent criticisms of this procedure was the superficial position of the nerve, where it is more prone to trauma. In 1917, Rudolf Klauser (54) (Fig. 5) described a technique of transposing the nerve into a muscular bed that was called the anterior intramuscular transposition. He had developed this method during the First World War to avoid tension at the site of repair of a transected nerve. It was Sir Harry Platt (Fig. 6A) who in 1926 drew attention to this method of treating ulnar nerve palsy. Two years later, he provided an illustrated description of the technique (75, 76) (Fig. 6B). In that era, many authors stated that they performed anterior transposition. It is not always clear, however, whether they transposed the nerve subcutaneously or intramuscularly (18, 19, 85). This is one of the reasons why comparing historical data from this period is extremely difficult, if not impossible.

In 1942, another technique of anterior transposition was described. Learmonth (57) reported in a two-page, well-illustrated publication the technique of anterior submuscular transposition (Fig. 7). Nowadays, all previously described techniques of anterior transposition are used.

Decompression of the nerve is an old technique that was also referred to as liberation of the nerve. Although Potherat should have been credited with performing the first liberation of an ulnar nerve in a patient of Mouchet’s (64, 69), the simple freeing of the nerve had been done before (in 1878), as discussed previously. In the beginning, this method did not have many supporters (68). One of the most frequent criticisms was that decompression does not alter the tension of the nerve during movement of an often-deformed elbow joint and therefore cannot be effective (15, 18, 42, 64, 69). Even in more recent times, this argument was used by opponents of the use of decompression procedures (55). Until 1957, decompression of the nerve was still an alternative surgical option, but not much attention was paid to it. An exact description of the technique did not exist. In describing cases, some authors reported that the ulnar nerve was liberated by incising the overlying connective tissue (21). One might assume that in all patients, liberation of the nerve meant undoing the nerve from its compressive covering.

Geoffrey Vaughan Osborne (72) was an orthopedic surgeon who was born in 1907. In 1957, while working in Liverpool, England, he reported the existence of a band of fibrous tissue bridging the head of the flexor carpi ulnaris, which lies directly over the ulnar nerve. He noticed that it was slack during elbow extension and tightened with elbow flexion. He supposed an analogy between ulnar nerve neuritis and carpal tunnel syndrome and therefore proposed that ulnar nerve compression was caused by compression and not by friction or traction as was generally believed. Division of the band that nowadays bears his name was sufficient to relieve the symptoms. In the beginning, much resistance was raised against this new concept (72). In 1959, Osborne (71) described the surgical technique in detail. The results obtained with it were as good as those described with transposition, even in the more severe cases. One year before, however, in 1958, William Feindel and Joseph Stratford (35, 36) (Fig. 8, A and B) had reported a similar observation. In three patients, they found a constriction of the ulnar nerve just distal to the medial epicondyle. At that point, the nerve dips to a deep submuscular course through an opening. The aponeurotic arch between the olecranon and medial epicondyle and the ligaments of the elbow joint forms the roof. They called this arched area...
the cubital tunnel and posited that compression of the nerve in its tunnel caused the symptoms and signs of ulnar nerve neuritis. Again compression was thought to be important in the pathogenesis of ulnar nerve palsy. Opening the roof of the cubital tunnel was considered a surgical alternative in the treatment of compression of the ulnar nerve at the elbow, and this procedure was referred to as decompression of the nerve. Feindel and Stratford even doubted whether the effect of anterior transposition should be attributed to the unrecognized effect of opening the cubital tunnel. Thus, Osborne, Feindel, and Stratford described nearly contemporarily the same clinical entity and therapy. On the one hand, Osborne was the first to report the fibrous band, and therefore this structure bears his name. On the other hand, decompression of the nerve is connected to the work of Feindel and Stratford because they described the technique in detail for the first time.

In 1950, Thomas King (51) (Fig. 9) described another technique: the medial epicondylectomy. He noted after removal of the bone in a patient with an imprisoned medial epicondyle from the elbow joint that the roughened bone was completely covered and that a smooth bed existed for the ulnar nerve, which had moved forward slightly and naturally into an anterior position. He realized that medial epicondylectomy avoided the most frequent criticisms of anterior transposition techniques: strangulation of the ulnar nerve and stretching of the nerve during arm extension. Francis P. Morgan (Fig. 10) contributed an appendix at the end of King’s report in which he described his considerations and a short description of the surgical technique that he had adopted from King. The advantages of this method are obviation of scarring in the flexor muscles, stretching of the ulnar nerve in arm extension, and not handling the nerve and its branches, which can be attributed to less pain and rapid recovery for the patient (51). In 1959, King and Morgan (52) reported their later results. Nowadays, the medial epicondylectomy is attributed to King and Morgan.

1960 to the present

From 1960 until today, no new concepts of surgical treatment have been developed. Since the evolution of minimally invasive neurosurgical techniques, however, an endoscopic procedure has been developed. It is focused on dividing the arcuate ligament and therefore is comparable to decompression of the ulnar nerve (61, 90). Increasing attention is paid to the results of the various methods. It is remarkable that the results prospective randomized trials of these treatment methods have never been published. Two studies comparing retrospective data from various reports have been published (12, 30). Because of the methodology of these studies, however, firm conclusions could not be drawn. To elucidate the ques-
tion regarding which treatment is best, carefully designed, prospective, randomized studies are warranted.

CONCLUSIONS

The history of the surgical treatment of compression of the ulnar nerve at the elbow can be divided into three periods. In the first period (1816–1897), ulnar compression as a clinical entity was described and the first report of a surgical treatment was published. This treatment (sectioning of the nerve)


did not gain much support. Much attention was paid to the subluxation and luxation of the ulnar nerve and therapy administered to treat patients with these presentations. The second period (1898–1959) was characterized by the description of all known surgical treatments. In the most recent period (1960–present), new techniques have not been developed, but evaluation of the results obtained with various treatments has been attempted. This overview is the first in the literature that provides information about and photographs of nearly all of the important people in the history of the surgical management of compression of the ulnar nerve at the elbow. As neurosurgeons, we must realize that we have played a modest role in these past treatment modalities and that we must make new efforts to develop peripheral nerve surgical techniques to prevent simply repeating what has been done in the past.

ACKNOWLEDGMENTS

We thank Caroline Duroselle-Melish, reference librarian of the historical collections of the New York Academy of Medicine, for her kind support in my search for several of the photographs published herein and for providing biographical data regarding Benjamin F. Curtis (Fig. 3). I also express gratitude to M. Tröbs, Stadtschiv, Stadt Coburg, Germany, for providing the biographical data regarding Rudolf Klauser. I am grateful to Victor Swoboda, Director of Communications of the Montreal Neurological Institute and Hospital, for providing biographical data about and a photograph of Dr. Feindel (Fig. 8A). He also led me to Dr. Stratford (Fig. 8), who very kindly provided me with his biography and photograph. Finally, I am indebted to Donald Simpson, M.D., for sending us a reprint of his publication containing a photograph of Frances P. Morgan (Fig. 10) as well as some biographical data.

FIGURE 10. Frances P. Morgan (1906–1988) (right) was a neurosurgeon working at St. Vincent's Hospital in Melbourne, Australia. He was trained by Cairns in the London Hospital from 1934 to 1937. He returned by invitation to St. Vincent's Hospital to become Honorary Neurological Surgeon. He built a neurosurgical service along modern lines. In 1938, he was joined by Arthur Schüller (left), who fled from Austria after the Nazi invasion. Schüller gave Morgan valuable support as a radiologist and clinical neurologist and even as a neurosurgeon. Schüller was elected an honorary member of the Neurosurgical Society of Australia, of which Morgan was one of the founders (87, 88) (reprinted from, Simpson DA, Jamieson KG, Morson SM: The foundations of neurosurgery in Australia and New Zealand. Aust N Z J Surg 44:215–227, 1974 [87, p 220], with permission from Blackwell Science Asia, Australia).

REFERENCES


COMMENTS

The surgical treatment of ulnar neurography remains controversial. Over the years, numerous surgeons have advocated a number of procedures, none of which has subsequently become predominant. This article describes some of the principal contributors and their contributions. The description of neurosurgical heritage provided here is both interesting and a stimulus to those working in the modern era, who surely have an obligation to use modern methodology and technology to delineate the best and preferred method of treatment in any particular case. Inevitably, readers may note the omission of their favorite contributors to this topic. The description of those included here, however, reminds readers of a rich surgical history that set the stage on which the modern scientific surgeon works.

Alan R. Hudson
Toronto, Ontario, Canada

Readers of Neurosurgery are indebted to Dr. Bartels for his interesting account of ulnar entrapment neuropathy and the biographical portrayals of surgeons who were pioneers in its surgical management. Dr. Bartels is correct in emphasizing that much controversy still exists with regard to the mechanism of entrapment, its precise site, and, of course, its surgical management. Lacking in this review, perhaps purposely, is a more contemporary assessment of where these controversies stand at present. In more recent years, some thought-provoking articles have been published, and many of them were authored by neurosurgeons.
Not documented in the article, whose main theme is surgical, are the more basic anatomic, neurophysiological, and pathological observations made in the past 40 years, which have helped clinicians understand the cellular pathogenesis of such entrapment neuropathies. Stimulated by Denny-Brown and Bremer’s observations about neuropathy caused by direct pressure and tourniquet, Gilliat and colleagues including Fullerton, Fowler, Neary, Jefferson, Ochoa, and Marotte made important observations in the guinea pig as well as in humans. Although ischemia may play some role, mechanical deformation, whether by pressure, friction, or deformation, produces segmental demyelination and remyelination heralded by bulbous paranoidal swellings known as tadpoles.

My personal view is that the site of spontaneous ulnar involvement in almost all cases is at the elbow and within the bony olecranon notch and not more distally in the forearm as suggested in some older articles. A series of 350 patients with entrapments published in 1995, reported again in 1997, and then again in 2000 with regard to direct intraoperative nerve action potential “inching” recordings on entrapped ulnar nerves demonstrated that in 50% of patients, conductive abnormalities began just proximal to the olecranon notch and were maximal through that area and not more distally. In most other patients, these abnormalities began on the olecranon notch portion of the nerve. In only six patients did conductive abnormalities begin distal to the bony olecranon notch. The series has since been extended to close to 500 patients, and the operative recording observations have had the same weighting. Thus, the site of involvement is usually within the olecranon notch, and indeed that usually correlates well with where the nerve appears most flattened, scarred, or tethered. Regardless of whether a simple neurolysis or a transposition is to be done, the nerve’s course through the olecranon notch needs to be freed up.

The more recent literature has suggested that epicondylectomy without neurolysis of the nerve well proximal and distal to the elbow has a relatively high recurrence rate. The more recent literature also has suggested that an intramuscular site for transposition is a poor one and that this procedure should not be done. A submuscular site is a good one, however, if a transposition is to be done. Many of these recent articles have been published by neurosurgeons, sometimes in conjunction with plastic and/or orthopedic surgeons, so, at least within the past 3 to 4 decades, neurosurgeons have contributed to the medical literature in this area.

David G. Kline
New Orleans, Louisiana

Dr. Bartels has written a most interesting history of the diagnosis and treatment of ulnar nerve compression at the elbow. This task is especially daunting because there was and is vigorous controversy with regard to the cause and proper treatment of this condition. I would have hoped to find more information on James Learmonth. His submuscular transposition article, although only two pages long and devoid of any results or follow-up, was a seminal work. He left it to others to find a use for his technique; they did, and this treatment modality remains important today. Most of the investigations in the late 19th and early 20th centuries concentrated on chronic injury to the ulnar nerve secondary to elbow deformity from an old fracture: the classic tardy ulnar palsy. Work done in the last 50 years has centered on idiopathic ulnar palsy presumably caused by repetitive strain injury, subclinical trauma, or perhaps a stenotic cubital tunnel. Mechanisms of this latter type of ulnar palsy are not as clear. Precise understanding of the pathophysiology is not available, hence there is uncertainty with regard to the best way to relieve the ulnar palsy. This uncertainty still exists because, as Dr. Bartels points out, no comparative prospective study of ulnar nerve surgery has yet been undertaken.

John E. McGillicuddy
Ann Arbor, Michigan

Future Meetings—Congress of Neurological Surgeons

The following are the planned sites and dates for future annual meetings of the Congress of Neurological Surgeons:

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<td>2001</td>
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<td>2002</td>
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<td>2004</td>
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Future Meetings—American Association of Neurological Surgeons

The following are the planned sites and dates for future annual meetings of the American Association of Neurological Surgeons:

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