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Hospital Topics

Cubital Tunnel External Compression Syndrome

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Summary

External compression of the cubital tunnel comprises the acute and subacute forms of ulnar nerve compression at the elbow. Subacute compression is often seen in hospital practice and sometimes results in partial crippling of the hand. Prognosis for complete recovery is poor. Avoidance of a position of the elbow which predisposes to external compression of the ulnar nerve within the cubital tunnel is advised when a patient is on the operating table, in bed or in an armchair. Prolonged severe elbow flexion in these circumstances should also be avoided. The patient suffering from the syndrome should be instructed to avoid further pressure so that worsening of the palsy is minimized. A compressed nerve is likely to be more sensitive than a normal nerve to ischaemia produced by subsequent pressure. Surgical treatment is sometimes indicated at least to halt progression of the palsy.

Introduction

Ulnar nerve palsy from compression at the elbow may conveniently be classified into three types (fig. 1): (1) *acute*, resulting from a single episode of force; (2) *subacute*, resulting from external pressure applied over a limited period; and (3) *chronic*. The chronic type includes pressure from lesions within the cubital tunnel (osteoarthritis, rheumatoid disease, ganglion, and other soft-tissue tumours) as well as diminution of the capacity of the tunnel from lateral shift of the ulnar and approximation of the roof to the floor. A common cause of the latter is injury to the capitular epiphysis leading to a deficient lateral trochlear lip¹ and sometimes to resultant "tardy ulnar palsy" in adult life.

FIG. 1—Diagram illustrating causative factors in chronic, acute, and subacute ulnar palsy, the acute and subacute constituting the cubital tunnel external compression syndrome. (Arrows indicate direction of pressure.)

Cases of the acute and subacute types due to external compression of the cubital tunnel have been only sporadically reported^{2,4} but it should be appreciated that the subacute form in particular is common in hospital practice. The degree of palsy can usefully be graded by following McGowan's⁷ description, which is mainly concerned with the condition of the interossei. Grade 1 consists of paraesthesiae and minor hypoaesthesia. Grade 2 consists of weakness and wasting of the interossei and medial two lumbricals with incomplete hypoaesthesia. Grade 3 consists of paralysis of the interossei and medial two lumbricals together with, in most cases,

FIG. 2—A, Acute trauma (case 1) resulting in grade 3 palsy with permanent partial crippling of hand. B, Similar permanent situation resulting from subacute trauma, which probably occurred on operating table (case 12).

severe wasting of the hypothenar and adductor pollicis muscles; there is obvious sensory disturbance and the hand is partly crippled, often with clawing of the ring and little fingers (fig. 2 A, B).

Cubital Tunnel

An understanding of the anatomy of the cubital tunnel is important (fig. 3 A, B). The nerve is accompanied by the ulnar collateral artery and there is an anastomotic arterial system contributed to also by the supratrochlear and posterior ulnar recurrent arteries, all of which supply the nerve in this part of its course. Proximally and distally the nerve is protected by muscle, but within the cubital tunnel it is unprotected and especially vulnerable to compression.

The floor of the tunnel is formed by the medial ligament of the elbow and, deep to this, the medial lip of the trochlea. The roof is the arcuate ligament which extends from a fixed point on the medial epicondyle to a moveable attachment at the olecranon. The roof, therefore, bridges the two heads of the flexor carpi ulnaris. The ligament is taut at 90° of elbow flexion and slack in extension, while the medial ligament bulges in flexion. Thus the ulnar nerve is subject to "physiological" compression in elbow flexion, a fact well known to Gowers⁸ when he described "ulnar nerve sleep palsy."

According to Vanderpool *et al.*⁹ the topography of the ulnar nerve in the cubital tunnel (fig. 4) exposes the fibres to the intrinsic muscles of the hand, together with the sensory fibres, to maximal risk from external compression while the fibres to flexor digitorum profundus and flexor carpi ulnaris in their deep situation tend to be spared.

FIG. 3—A, Arcuate ligament and ulnar nerve of left cubital tunnel shown in anteroposterior radiograph. B, Ulnar nerve (1) proximally and arcuate ligament (2) of left elbow before division of ligament and neurolysis (case 9).

FIG. 4—Topography of ulnar nerve in cubital tunnel. Intrinsic (A) and sensory (B) fibres lie superficially under arcuate ligament (Sunderland¹⁷).

Illustrative Cases

The main clinical details of 12 cases of acute or subacute ulnar nerve palsy due to external compression of the cubital tunnel are given in the table. In only one case (case 2) was

Clinical Details of 12 Cases of Acute or Subacute Ulnar Nerve Palsy due to External Compression of Cubital Tunnel

Case No.	Age	Sex	Predisposing Condition	Onset of Symptoms	Grade of Palsy	Operative Treatment	Review Period	Result	Residual Grip and Key Pinch Strength in lb (kg)	
									R./L.	R./L.
1	57	M.	Acute trauma. Right elbow crushed between tail-gate and bed of truck	Immediate numbness, progressive weakness, and wasting in hand over several months (R.)	3	4 months postinjury. Perineural adhesions around compressed nerve within cubital tunnel and for 2 cm distally released by external neurolysis. Hydrocortisone acetate injected around nerve; intraneural injection of saline	2 years	Subjective slight improvement in power and sensation. Grade 3 palsy. Clawing of ring and little fingers; fixed flexion deformities of P.I.P. joints of these digits. Elbow motion restricted to 30°/115°	80/80 (36.3/36.3)	16/22 (7.3/10.0)
2	55	M.	Acute trauma. Forcefully banged inner aspect of right elbow on machine. Excision of radial head 18 years previously after trauma; resultant restriction of elbow movement and osteoarthritic changes of R. knee	Immediate pain for several hours together with numbness. Progressive weakness and wasting in hand over next 3 months (R.)	2	5 Months postinjury. Nerve found to be compressed in cubital tunnel. Adhesions divided and anterior transposition of nerve performed	1½ Years	No change since operation. Grade 2 palsy. Elbow motion restricted to 15°/130°	60/80 (27.2/36.3)	10/18 (4.5/8.2)
3	48	M.	Medial meniscectomy of R. knee	Subjective numbness in ulnar distribution on awaking from anaesthetic (L.)	1	None	9 Months	Improvement but slight residual numbness. Grade 1 palsy	90/90 (40.8/40.8)	16/14 (7.3/6.4)
4	28	M.	Laminectomy for lumbar disc lesion	Possibly banged inner aspect of L. elbow on side rail of bed on 1st postoperative day. Awoke with numbness in ulnar distribution on 2nd postoperative day. Numbness and weakness progressed over the next few days (L.)	2	None	9 Months	No change. Grade 2 palsy	115/115 (52.2/52.2)	35/25 (15.3/11.3)
5	40	F.	Normal birth of 7th child in hospital	Numbness in ulnar distribution with weakness in hand noticed within first week after delivery (R.)	2	None	4 Years	No change. Grade 2 palsy with minor intrinsic weakness	50/60 (22.3/27.2)	14/14 (6.4/6.4)
6	32	M.	Trauma to right hip treated by bed rest and traction	Numbness in ulnar distribution, together with weakness in hand, noticed 3 days postinjury (R.)	2	None	2 Years	Was much improved 1 year postinjury but grade 1 palsy remained	85/85 (38.6/38.6)	19/19 (8.6/8.6)
7	56	M.	Pneumonia treated at home by bed rest for 2 weeks and antibiotics	Noticed numbness in ulnar nerve distribution and weakness in hand at end of 2-week period in bed; some progressive deterioration (L.)	2	None	6 Months	No improvement. Grade 2 palsy	100/65 (45.4/29.5)	22/14 (10.0/6.4)
8	64	M.	Total hip replacement for osteoarthritis of left hip	Numbness in ulnar nerve distribution and weakness in hand noticed on 5th postoperative day. Progressive weakness over several months (L.)	2	5 Months after onset of palsy. Compression of nerve and perineural adhesions, as well as intraneural fibrosis, found. External neurolysis and intraneural injection of saline performed	1½ Years	Definite but limited overall improvement. Grade 2 palsy	70/60 (31.8/27.2)	16/12 (7.3/5.4)
9	79	M.	Total hip replacement for osteoarthritis of left hip	Noticed bilateral numbness on 5th postoperative day. Progressive weakness in hands over next few weeks (R. and L.)	2	4 Months after onset. Mild constriction and adhesions found bilaterally. External neurolysis and intraneural injection of saline performed	2 Years	No change. Grade 2 palsy	70/70 (31.8/31.8)	11/10 (5.0/4.5)
10	18	M.	Trauma to nose and left hip. Internal fixation of intertrochanteric fracture of femur performed	2 Days postinjury noticed numbness bilaterally but this settled on right side several hours later. Weakness of left hand became profound, with clawing of ring and little fingers, several days later (L.)	3	None	2 Years	Had much improved 1 year later. Grade 2 palsy	80/60 (36.3/27.2)	18/14 (8.2/6.4)
11	62	M.	Inguinal herniorrhaphy. Hypermobile ulnar nerve. Prolonged sitting with elbows on chair arms for 3 months postsurgery. Similar situation recently after retirement	Subjective numbness 5 days postsurgery. Progressive weakness and wasting in hand over next year. Further deterioration in recent months (R.)	3	After recent onset of progressive deterioration. Compression of ulnar nerve in cubital tunnel together with adhesions and intraneural fibrosis. External neurolysis and anterior transposition of nerve performed	15 Years	No change since operation. Deterioration halted. Grade 3 palsy	55/70 (25.9/31.2)	9/15 (4.1/6.8)
12	55	F.	Exploratory operation and biopsy of lymphoma in body of T 10 vertebra. Operation followed by radiation therapy. Patient suffers from diabetes mellitus	Subjective numbness on awaking from anaesthetic followed by wasting in hand with clawing of ring and little fingers in the immediate postoperative period (R.)	3	None	12 Years	No change. Grade 3 palsy with clawing of ring and little fingers and P.I.P. joint flexion deformities of these two digits	17/35 (7.7/15.9)	4/11 (1.8/5.0)

there clinical or radiological evidence of an underlying elbow lesion; possibly slight lateral shift of the ulna had diminished the capacity of the tunnel and this, together with the osteoarthritic changes, could have contributed to the precipitation of ulnar palsy. Two of the patients almost certainly suffered acute trauma (cases 1 and 2). The others equally certainly suffered subacute trauma over a limited period but whether it occurred on the operating table, in the obstetric delivery room, or at a later time in bed (in particular, cases 4 and 5) is not always obvious. Local tenderness over the cubital tunnel is a constant feature, sometimes accompanied by distal paraesthesiae. In no case were the flexor carpi ulnaris and flexor digitorum profundus notably affected.

Cases 3 to 12 fall into the category of subacute trauma because the compressive force sustained was not severe but was continued over a period of minutes, hours, or days. Two patients were clearly affected while lying on the operating table. The operation in case 3 was completed in 15 minutes and the total time on the operating table was 30 minutes. In case 12 the exploration of a lymphoma in the tenth thoracic vertebra had been performed in the prone position; the patient had suffered from diabetes mellitus for many years.

The time of onset of symptoms in six cases of subacute compression (cases 6 to 11) suggests that the period of pressure occurred when the patient was lying in bed. In two cases the compression may have been sustained on the operating table (case 4), in the delivery room (case 5) or during the next few days when in bed. In case 4 the patient, who was drowsy for two days after a laminectomy, remembered banging his elbow on the side rail of the bed on the night of operation and he complained of sensory loss in the ulnar distribution on the second postoperative day. The sensory loss was more obvious by the fifth day. In case 5 the patient, who had been delivered normally in hospital, was uncertain whether the symptoms of ulnar palsy began in the delivery room, but sensory deficit and clumsiness of the hand were definite one week later.

Discussion

That cases of ulnar palsy occur quite often in hospital practice is surprising. Many of the cases have followed elective surgery or confinement to bed for other reasons. The anatomical relations of the ulnar nerve within the cubital tunnel render it susceptible to compression ischaemia and every effort should be made to prevent external pressure over this vulnerable area. Also, since the nerve is compressed by the arcuate ligament in elbow flexion, prolonged periods of extreme flexion should be avoided in bedridden patients.

The present cases of cubital tunnel external compression syndrome were acute or subacute. Apart from case 2, there was no clinical or radiological evidence of a causative lesion of the elbow in these patients and, with the one exception, we believe the symptoms and signs to have been due entirely to external compression. Classification of the condition is convenient for descriptive purposes. In practice, however, there is a "grey zone" wherein it is not always certain, for instance, whether acute trauma may have occurred at the time of an incident (case 4) or an accident (case 10). Equally, it is sometimes impossible to be sure when subacute compression occurred. Clearly it began on the operating table in cases 3 and 12, and in bed in cases 6, 7, 8, 9, and 11.

Certain positions put the ulnar nerve within the cubital tunnel at risk (figs. 5 and 6). In general, when the arm is abducted on an arm-board or tethered at the side of the body full supination of the forearm "lifts" the cubital tunnel and ulnar nerve away from the surface while pronation puts the nerve in a position of risk. Of course, in the extreme flexed position with the tunnel resting on the surface, the nerve is doubly at risk from external compressive force and from "physiological" pressure by the arcuate ligament.

A combination of aetiological factors may operate. Im-

FIG. 5—Positions of upper limb on operating table that put cubital tunnel especially at risk from external pressure (A). Pronation of the forearm rotates cubital tunnel into "at-risk" position while full supination lifts nerve away from surface. Flexed position with surface contact appears especially hazardous. Several "safe" positions are shown (B).

FIG. 6—A, "At-risk" position in full pronation. B, Full supination frees cubital tunnel from surface and protects ulnar nerve.

portant accessory local factors may be a shallow cubital tunnel, an abnormal degree of compression in elbow flexion by the arcuate ligament, and possibly relatively poor vascularity of this segment of the nerve. Hypermobility of the nerve increases the risk of compression while the nerve is dislocated superficially in elbow flexion, and one of our patients exhibited this phenomenon (case 11). External trauma may precipitate tardy ulnar palsy in the abnormal elbow, as may have happened in case 2. One can postulate such general conditions as diabetes mellitus, alcoholism, vitamin deficiency, and malignancy rendering peripheral nerves susceptible to compression problems; in only one of our patients (case 12) was there any such condition.

Whether the pathology within and around the nerve after external compression is due to mechanical deformation or to ischaemia or to a combination of both is uncertain. According to Sunderland,¹⁰ "the available evidence points to a local disturbance of axoplasmal structure which is confined to the damaged segment, and/or a slowing or arrest of 'the centrifugal flow inside the axon of substances or factors vital for the maintenance of axonal integrity.' Providing the causative agent ceases to act before the critical point is reached at which axonal disintegration sets in, the changes responsible for the block are, whatever their nature, fully reversible and function is rapidly and completely restored." Unfortunately, the "critical point" cannot be obvious clinically, and the only safe approach is to avoid pressure altogether over this vulnerable segment of nerve. Damaged nerve fibres are more sensitive to ischaemia than normal fibres^{11,12} and it is important, therefore, to watch for the presence of the cubital tunnel external compression syndrome in hospital practice; the patient should be informed whenever the syndrome is present and advised that all forms of pressure over the cubital tunnel must be prevented, as should prolonged periods of severe elbow flexion. Adequate follow-up by the clinician is necessary and the prognosis should be guarded. From our experience in this series normal sensation never returns and such a significant improvement of severe muscle weakness as occurred in case 10 is unusual.

The place of surgical treatment in the cubital tunnel external compression syndrome cannot at present be well defined. The amount of force and length of time it has been applied probably determine whether only the superficial epineurium is affected or whether the interfunicular connective tissue, the perineurium, and, finally, the intrafunicular tissue is involved. Even when a nerve is superficially involved it may be surrounded or even buried in scar tissue. External neurolysis is sometimes performed in the belief that scar tissue is blocking conduction or hindering regeneration, as in cases 1, 2, 8, 9, and 11. Surgical intervention halted the progression in cases 2, 9, and 11, while there was limited reversal of the palsy in cases 1 and 8. The indication for internal neurolysis is even more difficult to assess. It was performed by saline injection in cases 1, 8, and 9 because of intraneural thickening. Sunderland¹³ believes that interfunicular injection of saline is no substitute for careful intraneural exploration, and if the latter is contraindicated because of dense scarring intraneural injection of fluid will anyway be ineffective. Never-

theless, injection of saline may indicate the amount of intraneural fibrosis and so be helpful in prognosis.

Surgical exploration is indicated when there is progressive deterioration over several months. After neurolysis the nerve can be left free with the arcuate ligament sewn deep to it,¹⁴ the nerve can be transposed anteriorly¹⁵ or the medial epicondyle and adjacent supracondylar ridge removed.¹⁶ Anterior transposition of a dislocating, hypermobile nerve which is the subject of neuropathy is mandatory.

Early recognition of the cubital tunnel external compression syndrome and a fully-informed patient aware of the danger of subsequent external pressure over the cubital tunnel set the stage for a more favourable outcome. Positions on the operating table, in bed, or in the armchair that put the cubital tunnel at risk from external pressure should be avoided and active elbow movement encouraged in bedridden patients.

It is a pleasure to acknowledge the help and encouragement of colleagues in different specialties and from several hospitals, and particularly so for providing many cases, not all of which are included in the present series.

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Cryodestruction of Haemorrhoids

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Summary

Thirty-seven cases of second and third degree haemorrhoids have been treated by cryosurgery. Although the number of cases treated is small and the follow-up is short, we are greatly encouraged by the early excellent results. It is a simple and

effective procedure with minimal complications, and it is especially recommended for those patients who are medically unfit for general anaesthesia. The rapidity of this procedure combined with the painless operative and postoperative course enables the patient to leave hospital the next day. More cases with long-term follow-up are needed before adequate evaluation of this form of treatment can be made.

Introduction

During a clinical trial of cryosurgery for advanced and recurrent cancers of the skin (to be reported) an inoperable carcinoma of the anal canal and a perineal recurrence after abdominoperineal resection were treated. We were impressed

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