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Radial palsy in shaft fracture of the humerus

Fifty-nine patients with immediate and 16 with secondary radial nerve palsy complicating a fracture of the shaft of the humerus were reviewed. According to the preferences of the surgeon in charge, the palsy was treated either with early exploration of the radial nerve and internal fixation of the fracture or with initial expectance. Of the latter, 12 were later explored.

No useful recovery of motor function could be seen in 13/59 patients with immediate and in 2/16 patients with secondary palsy. In patients with immediate palsy treated by early exploration, there were 8/27 nonrecoveries. Among those treated with initial expectance, there were 5/32 nonrecoveries. For secondary palsy, these figures were 2/10 and 0/6, respectively.

No support emerged for routine early exploration.

Ole Böstman
Georg Bakalim
Seppo Vainionpää
Eero Wilppula
Hannu Pätiälä
Pentti Rokkanen

Department of Orthopedics and Traumatology, Helsinki University Central Hospital, Töölö Hospital, SF-00260 Helsinki, Finland

Correspondence: Dr. Böstman, Tirholmsvägen 11 A3, SF-00200 Helsingfors, Finland

Radial nerve injury constitutes a major problem in the treatment of fractures of the shaft of the humerus, the average frequency estimated from the literature being 11 per cent (Pollock et al. 1981). However, there does not seem to be any consensus as to how to manage the condition, and the reported rate of poor recovery of the radial nerve function shows an amazing variation from nil (Pollock et al. 1981) to 31 per cent (Sim et al. 1971).

We have analyzed the irreversible radial nerve injuries associated with fractures of the humeral shaft seen at one large accident department over a period of 20 years.

Patients and methods

During the years 1961–1980, a total of 75 patients with complete radial nerve palsy complicating a fracture of the shaft of the humerus were treated at our accident department. There were 59 patients with an immediate primary palsy, complete already on admission, and 16 patients with a delayed, secondary type of radial nerve palsy seen first after the primary closed treatment.

The mean age of the patients was 34 (6–79) years. There were 56 men and 19 women. In a majority of the cases, the fracture was caused by a road traffic accident. The fracture was located in the middle third of the humeral diaphysis in 36 and in the distal third in 39 patients. The shape of the principal fracture line was transverse in 34 and spiral or oblique in 41 patients.

An early exploration of the radial nerve and internal fixation of the fracture within 3 weeks of the accident were performed in 37 patients, 19 of whom were operated on as emergency procedures. An initial watchful expectance consisting of regular clinical and electrophysiologic examinations was the policy of management in the remaining 38 patients. Of these 38 patients, 12 showed no signs of spontaneous recovery within 4 months and hence were subsequently subjected to a delayed exploration of the radial nerve, on an average 17 weeks after the accident. The decision of the policy in an individual patient, early exploration versus initial expectance, was made by the senior orthopedic surgeon concerned according to his personal preferences. Open fractures plus those occurring in patients with multiple skeletal injuries, however, were usually operated on early. These two categories comprised 22 of the patients.

At follow-up, nonrecovery of the radial nerve function was not considered irreversible and permanent until 3 years had passed. Patients with partial recovery but without restored useful motor function of the radial nerve were classified as nonrecovered.

Table 1. Observations in 75 patients with a radial nerve palsy complicating a fracture of the humeral shaft

A	B	C	D	E	F	G	H	I	J	A	B	C	D	E	F	G	H	I	J
1	14	M	S	M	T	–	–	–	+	39	35	M	I	D	O	+	2	i	+
2	37	M	I	M	T	+	96	i	–	40	44	F	I	M	T	+	3	i	+
3	15	M	I	D	S	–	–	–	+	41	43	M	I	M	T	+	1	i	–
4	46	M	I	M	O	+	180	i	+	42	70	M	I	D	S	+	102	i	+
5	62	M	I	M	T	+	2	b	+	43	28	M	I	D	S	+	1	i	+
6	54	M	I	M	T	+	125	e	–	44	37	M	S	M	T	+	2	b	+
7	29	M	I	M	O	–	–	–	+	45	22	F	I	M	T	–	–	–	+
8	26	M	S	M	O	–	–	–	+	46	23	M	I	D	S	+	1	b	+
9	35	F	I	M	T	+	15	b	+	47	29	M	S	D	O	+	1	i	+
10	41	M	I	D	O	+	3	i	+	48	52	M	I	D	S	+	10	b	+
11	18	F	I	D	O	+	1	I	+	49	26	M	I	D	O	+	3	I	+
12	27	M	S	D	S	+	2	b	–	50	31	F	S	D	T	–	–	–	+
13	16	M	I	D	T	–	–	–	+	51	15	F	S	D	S	+	1	i	+
14	6	M	S	M	T	–	–	–	+	52	79	M	I	M	O	–	–	–	+
15	33	M	I	D	S	+	1	I	–	53	40	F	I	D	S	+	2	f	+
16	42	M	I	M	T	–	–	–	+	54	62	M	I	D	T	–	–	–	+
17	67	M	I	M	T	+	13	b	–	55	31	M	S	D	T	–	–	–	+
18	37	M	I	M	T	+	1	i	–	56	20	M	I	D	O	+	1	f	+
19	54	M	I	D	S	+	19	b	–	57	25	M	I	M	T	+	2	b	+
20	13	F	I	M	T	–	–	–	+	58	29	F	I	D	O	+	3	i	+
21	33	M	I	D	T	+	102	i	+	59	59	F	I	M	T	–	–	–	+
22	24	M	I	M	O	+	126	i	+	60	38	M	I	D	S	+	1	I	+
23	21	M	I	M	O	+	142	I	–	61	35	M	S	D	O	+	2	b	+
24	36	M	I	D	O	+	90	e	–	62	61	F	S	D	T	+	6	i	+
25	22	M	I	M	O	–	–	–	+	63	18	M	I	M	T	–	–	–	+
26	54	M	I	M	O	–	–	–	+	64	30	M	I	D	O	+	78	e	+
27	18	M	I	M	T	+	3	b	+	65	32	M	I	D	S	–	–	–	+
28	58	F	I	D	S	+	1	f	–	66	41	F	S	D	O	+	2	i	+
29	14	M	I	M	T	–	–	–	+	67	31	F	I	D	O	+	5	f	+
30	47	F	S	D	S	+	2	i	+	68	58	F	I	D	T	–	–	–	+
31	32	M	I	M	T	+	131	e	–	69	49	M	I	M	O	+	3	b	–
32	13	M	S	M	T	+	1	b	+	70	67	M	I	M	T	+	1	i	+
33	16	M	I	M	T	+	92	I	+	71	45	M	I	M	O	–	–	–	+
34	22	M	I	D	O	+	3	b	+	72	71	F	I	D	S	–	–	–	+
35	24	M	I	D	S	+	114	e	+	73	15	M	I	D	O	+	1	I	–
36	37	M	I	D	T	–	–	–	+	74	26	M	I	M	T	–	–	–	+
37	28	M	I	D	T	–	–	–	+	75	51	F	S	M	T	–	–	–	+
38	20	F	S	M	O	+	3	i	–										

A = Patient no.; B = Age; C = Sex; D = Type of palsy (I immediate, S secondary); E = Site of fracture (M middle, D distal third of diaphysis); F = Shape of principal fracture line (O oblique, S spiral, T transverse); G = Exploration; H = Time of exploration (days after accident); I = Findings and undertaken measures at exploration (b slight bruising, e entrapment in callus; neurolysis, f interposition between fragments; deliberation, i apparently intact, I laceration; neurorrhaphy); J = Useful recovery.

Results

There were 15 patients with no useful recovery of the radial nerve function. Nonrecovery was seen in 13/59 patients among those with an immediate palsy and in 2/16 among those with a secondary palsy (Tables 1 and 2).

When the policy of management had been early exploration, there were 10 nonrecoveries out of 37, whereas with initial expectance and, if required, delayed exploration, their number was 5 out of 38.

Among the patients under initial expectance, the radial nerve function spontaneously recovered in 20 out of 32 immediate palsies, whereas all six of the secondary palsies under experctance recovered, and consequently a delayed exploration was not required in any of these.

At exploration a condition calling for active measures – a disruption of the continuity of the nerve, interposition between the fragments or entrapment in callus – was found in 16 out of the 49 explored patients (Table 2). Among these there were 7 nonrecoveries. Of the remaining explored 33 patients with a radial

Table 2. Policy of management, findings at exploration, and recovery of radial nerve function

	Useful recovery	No recovery
Immediate palsy		
Early exploration		
Laceration requiring neurorrhaphy	3	2
Interposition between fragments	3	1
Contused or apparently intact nerve	13	5
Initial expectance		
Spontaneous recovery	20	
Delayed exploration		
Laceration requiring neurorrhaphy	1	1
Entrapment in bulky callus	2	3
Contused or apparently intact nerve	4	1
Secondary palsy		
Early exploration		
Laceration requiring neurorrhaphy	–	–
Contused or apparently intact nerve	8	2
Initial expectance		
Spontaneous recovery	6	
Total	60	15

nerve macroscopically intact or showing some bruising, 8 did not recover. There were 5 patients with an immediate type of palsy managed by early exploration among these 8 nonrecoveries. All 5 palsies were caused by high-energy road traffic accidents, and in 3 of these palsy patients treated in the 1960s, the rigidity of the internal fixation was insufficient, resulting in a bulky callus formation.

A condition necessitating active measures at exploration was found more often in spiral or oblique fractures of the distal third (in 12 out of 27) than in other types of fractures (in 4 out of 22).

The age of the patient had no influence on the outcome of the radial nerve injury.

Discussion

When managing a fracture of the humeral shaft complicated by a radial nerve injury, the surgeon is faced with a dilemma. Could the patient possibly benefit from an early exploration of the nerve? Neither clinical nor electrophysiologic examinations are able to answer this question (Sunderland 1963),

A look at the recorded rates of nonrecovery in the literature (Table 3) causes perplexity. Series have been reported in which more than 80 per cent of the patients have been treated conservatively, with nearly all of them recovering spontaneously (Mast et al. 1975, Pollock et al. 1981). On the other hand, there are reports advocating methodical, early exploration, based on an apparently high nonrecovery rate among the patients not explored in the early phase (Sim et al. 1971, Packer et al. 1972). However, just in these series, curiously, many patients showing no spontaneous recovery were not explored (Table 3). Unfortunately, comparisons between and with the previously recorded series are compromised by the heterogenity of the reported patients – some series including partial palsies and supracondylar fractures as well.

Table 3. Recovery of radial nerve function after palsy complicating fracture of the humeral shaft in the literature

Authors	No. of fractures	Useful recoveries/Nonrecoveries			Total nonrecoveries	
		Early exploration	Delayed exploration	No exploration (spontaneous recovery)	No.	Fraction
Kettelkamp & Alexander (1967)	30	9/2	3/–	16/–	2	0.1
Shaw & Sakellarides (1967)[1]	36	5/–	6/9	15/1	10	0.3
Sim et al. (1971)	68	18/2	14/11	15/8	21	0.3
Packer et al. (1972)	31	17/1	2/4	5/2	7	0.2
Hosner (1974)	10	1/–	3/1	5/–	1	0.1
Mast et al. (1975)	42	5/2	–/–	34/1	3	0.1
Pollock et al. (1981)	24	1/–	1/–	22/–	–	–
Present series	75	27/10	7/5	26/–	15	0.2
Total	316	83/17	36/30	138/12	59	0.2

1. Postoperative palsies omitted.

The results of early exploration will always seem superior to those of delayed exploration because the former will include patients whose radial nerve function would have recovered spontaneously without any surgical intervention. So, if a comparison is to be made, it has to be between the results of early exploration on the one hand and the results of delayed exploration plus the spontaneously recovered patients minus the patients with no recovery but not explored, i.e., the neglected ones, on the other. Calculated in this way, the total nonrecovery rate in the quoted reports was 11 per cent for early exploration and 15 per cent for initial expectance. The corresponding values in our series were 27 and 13 per cent, respectively, the criteria for useful recovery probably being among the strictest.

In our study, no single common denominator emerged for the nonrecoveries. A few of the cases were seen in patients with a laceration of the radial nerve that did not regain function after neurorrhaphy. Several, with preserved continuity, were associated with the occurrence of abundant callus at the fracture site. In one half the factors responsible for the poor recovery remained obscure, but the possibility cannot be ruled out that a nerve, potentially able to spontaneously recover, had received additional damage from the exploration.

There was no difference between an early and a later operation in the recovery rates after a lesion requiring neurorrhaphy. Moreover, recently, useful recovery of the radial nerve function has been reported by sural nerve grafting performed up to 2 years after the injury (Fisher & McGeoch 1985). Previous reports of radial nerves trapped in callus are scarce, but Spak (1978) has recorded 2 cases of successful neurolysis.

Our findings support watchful expectance as the principal initial policy of management in both immediate and in secondary radial nerve palsies. However, early exploration of the nerve and rigid internal fixation of the fracture could be considered in fractures showing a bayonet position between the fragments, apt to result in an abundant callus formation, thus endangering the recovery of the radial nerve.

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