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Focal Neurological Complications of Handcuff Application

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ABSTRACT: The application of handcuffs may result in compression neuropathies at the wrist. The frequency of these complications is unknown. Twelve of 190 (6.3%) consecutive subjects kept in police custody presented distal neurological symptoms possibly related to handcuff application. The duration of handcuffing was significantly longer in patients with neurological symptoms than in patients without neurological symptoms (mean \pm SD: 3.7 \pm 5.2 h vs. 1.8 \pm 2.6 h, $P = 0.02$). A long duration of handcuff application and, possibly, the existence of somnolence or acute alcohol intoxication could be predisposing factors to handcuff neuropathy. A prospective study of clinical and electrophysiological detection and follow up is needed.

KEYWORDS: forensic science, legal medicine, police custody, handcuff, neuropathy, compression, alcohol

The application of handcuffs may result in compression neuropathies at the wrist. The first cases were reported in 1978 (1,2). Involved nerves include the superficial branch of the radial nerve, the ulnar nerve, and the median nerve (1–6). Multiple nerves may be involved (4–6). The duration of symptoms and their reversibility are unknown in most cases, but inability to grip persisted for over one year in one patient (4) and numbness for over three years in another one (7). Only isolated cases have been reported (8), and it has been estimated that radial neuropathy due to handcuff pressure represented at least 18 cases in 1600 neurologic consultations in a New York City prison (9). A series of 41 patients with neurologic symptoms attributed to overtightened handcuffs has been reported since the completion of this manuscript (10). However, a control group of asymptomatic patients was absent in this study and the frequency of these complications as well as the existence of predisposing factors are unknown. One reason might be that many people with such injuries fail to return for clinical assessment, follow up, or investigation (4,10,11). We conducted a prospective study including clinical evaluation and interview of patients kept in police custody. Our objectives were to determine the frequency of focal neurological symptoms ascribed to handcuff compression

and to evaluate risk factors possibly involved in the occurrence of these complications.

Methods

Patients evaluated were subjects kept in police custody. Interview and clinical examination were performed in the Forensic Medicine Unit of Hôtel-Dieu Hospital in Paris during the course of a systematic medical examination performed to determine if the condition of the subject was good enough for him to be kept in police custody. Subjects were interviewed about the duration of handcuff application, the existence of psychotropic substance intake, and the presence of symptoms possibly related to a preexisting peripheral neuropathy. Clinical examination included skin examination of forearms and wrists, examination of touch and pain sensibility, muscle strength testing, and tendon reflexes. Clinical and interview data were obtained by the same physician in all subjects evaluated.

Results

A total of 198 consecutive subjects were examined, of whom 190 could be evaluated, i.e., in adequate general clinical condition and without obvious cognitive disorder. The examination was performed after 4.5 \pm 9.7 h (median time \pm SD) of police custody. In 12 cases of 190 (6.3%), we found clinical symptoms suggesting focal nerve compression related with handcuff application. Patients' characteristics are presented Table 1. Clinical presentation included local abrasion and swelling (2 of 12), pain (8 of 12), numbness (6 of 12), paresthesias (5 of 12), and motor deficit (4 of 12). Both arms were affected in 9 of 12 cases (75%). Symptoms were purely sensory in 8 of 12 cases (67%). A motor and sensory involvement was present in 4 of 12 cases (33%). There was no case of purely motor involvement. Clinical presentation suggested the involvement of ulnar nerve in four cases and radial nerve in one case. Diffuse hand paresthesias, numbness, or pain were observed in seven cases. In one case, the patient reported that the symptoms, which corresponded to ulnar nerve sensory involvement, were present since the previous time when he had been handcuffed, six months before. In most cases, handcuffs were applied at the time of arrest and during transports to or from jail, but not when the subjects were in jail. All subjects evaluated were handcuffed hands behind their back. The duration of handcuff application was significantly longer in patients with neurological symptoms than in patients without neurological symptoms (mean \pm SD: 3.7 \pm 5.2 h vs. 1.8 \pm 2.6, unpaired t test, $P = 0.02$). All subjects evaluated were handcuffed hands behind their back. In 21 of 190 (11%) cases, handcuffs were applied in violent circumstances. No differ-

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TABLE 1—Patient's characteristics.

| | Affected Patients (%) | Unaffected Subjects (%) | P value |
|---|-----------------------|-------------------------|-----------|
| Age (years, mean ± SD) | 27 ± 7 | 29 ± 9 | 0.57, NS* |
| Sex (M/F) | 12/0 | 158/20 | 0.62, NS† |
| Duration of handcuff application (h, mean ± SD) | 3.7 ± 5.2 | 1.8 ± 2.6 | 0.02* |
| Violent circumstances of handcuff application | 1 (8) | 20 (11) | 1.00, NS† |
| Alcohol intake | 4 (33) | 25 (14) | 0.09, NS† |
| Psychotropic substance intake | 9 (75) | 104 (58) | 0.37, NS† |
| Somnolence | 2 (17) | 5 (3) | 0.06, NS† |

* Unpaired *t* test; † Fisher's exact test; NS: not significant.

ences were found for the frequency of handcuff application in violent circumstances between patients with and patients without neurological symptoms (Fisher's exact test: *P* = 1.00). Although not statistically significant, there were trends to a more frequent acute alcohol intake and to a higher frequency of somnolence in patients with neurological symptoms than in patients without such symptoms (4 of 12 [33%] vs. 25 of 178 [14%], Fisher's exact test: *P* = 0.09; and 2 of 12 [17%] vs. 5 of 178 [3%], *P* = 0.06). No significant differences were found for age, sex ratio, and the intake of psychotropic substances between patients with and patients without neurological symptoms (Table 1).

Discussion

We found that distal neurological symptoms possibly related to handcuff application were frequent events in subjects kept in police custody, affecting as many as one of 16 subjects. A long duration of handcuff application and, possibly, the existence of somnolence or acute alcohol intoxication could be predisposing factors. This study has some limitations. Electrophysiological studies and clinical follow up could not be performed because patients were lost to follow up after the end of police custody, being either discharged and failing to attend neurophysiological examination, or kept under arrest in another place. Such difficulties in completing clinical and electrophysiological studies in people transiently kept in police custody have been reported previously (4,10,11). Moreover, we could not estimate the degree of tightness of the restraints, since it was not possible to examine patients with the actual handcuffs responsible for injury still in place.

As mentioned, persistent symptoms can be observed. According

to our results, the long duration of handcuff application could be a predisposing factor. It has been suggested that handcuffed individuals taking alcohol or other psychotropic substances fail to realize that their handcuffs have been applied too tightly and may continue to struggle with consequent nerve injury (3). We cannot rule out this hypothesis, especially in the case of alcohol. However, in the present study, the proportion of affected patients having taken psychotropic substances did not differ significantly from that of asymptomatic control subjects. In the UK, the application of rigid handcuffs has raised the hypothesis of serious injuries associated with its use, although extensive medical study and follow up of their complications is lacking (9,12). Given present indications on the incidence of complications due to handcuff application, we believe that a prospective study of clinical and electrophysiological detection and follow up is needed. Setting up such a study requires cooperation with police and legal authorities. Since such injuries are preventable, police officers should be requested to respond promptly to complaints of handcuff-related wrist compression in people kept in police custody.

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