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Methadone concentrations in human hair of the head, axillary and pubic hair

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Summary. The concentrations of methadone and its metabolites in the hair of the head, axillary and pubic hair obtained from patients receiving a daily maintenance doses, were determined. Comparison of the concentrations provides the highest values in the axillary hair, followed by pubic hair and the hair of the head.

Key word: Methadone, in human hair

Zusammenfassung. In Kopf-, Achsel- und Schamhaaren von Patienten, die täglich Methadon erhalten haben, wurden die Konzentrationen des Methadons und Metaboliten bestimmt. Die vergleichenden Bestimmungen in den verschiedenen Haaren zeigten die höchsten Konzentrationen im Achselhaar, gefolgt von Scham- und Kopfhaaren.

Schlüsselwort: Methadon, in menschlichen Haaren

Introduction

Determination of drugs in hair of the head has been documented (Baumgartner et al. 1979; Klug 1980; Baumgartner et al. 1981; Smith and Pomposini 1981; Valente et al. 1981; Baumgartner et al. 1982; Püschel et al. 1983; Smith and Liu 1986; Balabanova et al. 1987; Balabanova and Wolf 1988).

Recently, we reported also the presence of methadon in human hair obtained from patients receiving daily methadone (Balabanova and Wolf 1988). However, data on the occurrence of the drug in axillary and pubic hair are not available.

In this study we investigated the presence of methadone in axillary and pubic hair.

Material and methods

Simultaneously hair samples from the head, axillae and pubes were obtained from 10 patients receiving a daily maintenance dose of methadone.

From one patient only hair of the head and pubic hair, from two patients hair of the head only were obtained. The patients were aged 20–26 years (4 women, 9 men). The daily maintenance dose was 10–25 mg methadone hydrochloride per os.

The hair samples were washed with 10 ml distilled water and 10 ml ethanol 3 time each. 50 mg hair sample were cutted in 1 mm pieces approximately, than incubated overnight at 45°C with 1 ml 0.1 HCl. The acid extracts were neutralized with 100 µl 1 m NaOH. To the extracts 0.9 ml phosphate buffer (pH 7.4) were added.

The concentrations of methadone were determined by a modification of the radioimmunoassay for methadone in urine (Biermann, Germany). The standard was methadone hydrochloride diluted in phosphate buffer (pH 7.4). The standard curve covers the range 2.5 ng/ml–500 ng/ml. The antibody prepared in sheep was coated to the tubes. The tracer was 125-I-labelled methadone hydrochloride. The intra- and interassay coefficients of variation were 7.9% ($n = 7$) and 9.2% ($n = 37$). The cpm for the unknown samples were converted to nanogram equivalents per milliliter by use of the calibration curve, and then converted to nanogram per milligram hair. All determinations were performed in duplicate.

Results

The highest methadone concentrations were found in axillary hair, followed by pubic hair and hair of the head. The concentrations measured ranged from: a) axillary hair 1.3–8.0 ng/mg hair; b) pubic hair 1.0–4.0 ng/mg hair; and hair of the head 0.5–2.7 ng/mg hair (Figure 1). The methadone values found in the different kind of hair of each patient were depicted in Figure 2.

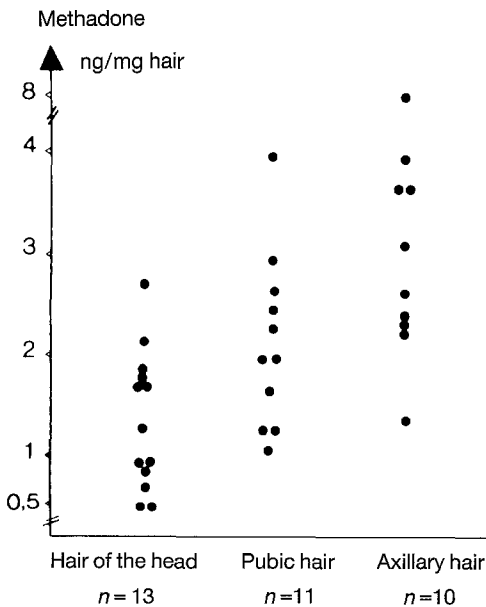


Fig. 1. Methadone concentrations in hair of the head, pubic and axillary hair samples

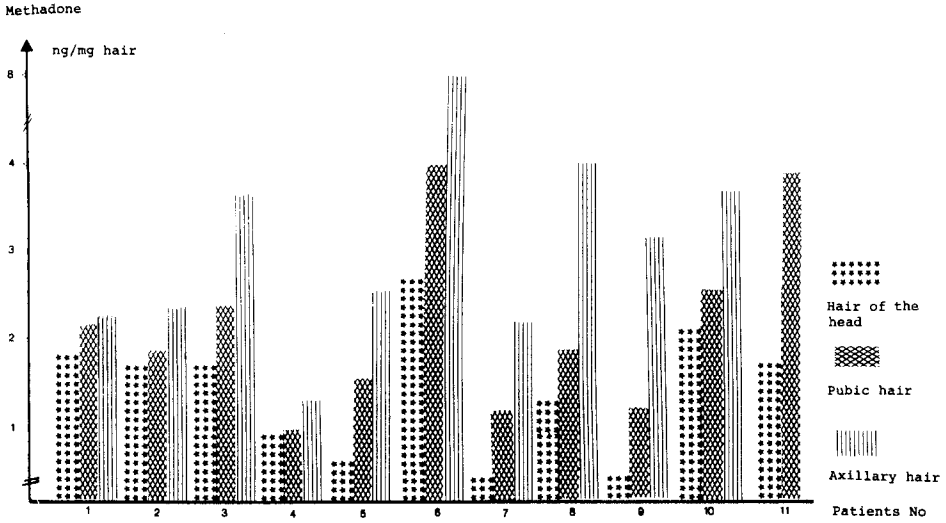


Fig. 2. Methadone concentrations in hair of the head, pubic and axillary hair for each patient

Discussion

Methadone is metabolized largely to 2-ethylidene-1.5-dimethyl-3.3-diphenylpyrrolidine (EDDP) and 2-ethyl-5-methyl-3.3-diphenylpyrroline (EMDP). No extent in plasma or tissues EDDP or EMDP during usage of methadone was also described (Baselt 1982). A small amounts of methadol and normethadol are produced and are presented in plasma (Baselt 1982). The antibody used in the present study react with methadone but also with its metabolites.

Consequently our results present the sum of methadone and its metabolites. The significantly differences of the methadone concentrations in axillary and pubic hair, and hair of the head observed in this study, may be explained by the different growth and long of the hair.

The hair of the head grows 0.39 up to 0.44 mm per day (Fuchs 1920; Saitoh et al. 1969) and if left uncut can grow as long more than 100 cm. The drugs transported from blood into the hair matrix are distributed in the full length of the hair. Consequently the concentrations in the single segments are lower.

The axillary and pubic hair growths up to 0.37 mm per day initial (Trotter 1963). Both axillary and pubic hair, varie between 1 and 60 mm in length. The disposition of the drugs take place only in this length. The concentrations in each segment are highest.

The difference between the methadone concentrations found in axillary and pubic hair again, can be explained by the better blood circulation in the axillea. This make possible that more methadone is transfered from blood into the axillary hair. Moreover, it is possible that methadone secreted by perspiration into the axillea is reabsorbed into the skin, and then transfered in the axillary hair. This hypothesis remains to be investigated.

In conclusion, our results showed, that methadone is present also in axillary and pubic hair. As a rule the axillary and pubic hair remained uncut. Con-

sequently the determination of drugs in these hair makes it possible to provide better a post and present drug use.

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