SHORT COMMUNICATION

RELEASE OF COPPER IONS FROM AN INTRA-VAS COPPER-WIRE CONTRACEPTIVE DEVICE*

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Summary: Insertion of a copper wire into the vas deferens of male rats released 4 micrograms of copper in the mid portion of the vas deferens in two days time. In urethral and epdidymal segments of the vas deferens copper released was less than one microgram. The present study demonstrates that the *in vivo* effects of 4 microgram of copper in 2 days time in the vas deferens are enough to induce antifertility in rats.

Key words: copper intra vas device copper release antifertility effect

INTRODUCTION

Copper as an adjunct to inert intrauterine device has been reported to produce some adverse direct effects on the spermatozoa (8). Furthermore, *in vitro* and *in vivo* studies with metallic salts have been reported to cause complete immobilization of human spermatozoa after some latent period (1,2,6). Intra-vasal copper device in male rats for 45 days has also been observed to affect fertiliy (7). However, the precise amount of copper needed to achieve this effect has not been determined. Accordingly, the present study was undertaken to determine the amount of copper ions released from an intra-vas copper device.

MATERIALS AND METHODS

Colony bred adult male albino rats (weighing 130-150 g) were used in this study. A piece of clean, pure metallic copper wire (0.1 mm in diameter and 1 cms in length) was inserted unilaterally in the lumen of mid portion of the vas deferens of all the animals follwoing the method of Chang and Tatum (1). The operations were done under aseptic conditions; and a group of 5 rats each was sacrificed at 2,7,14,21 and 28 days after intra-vas deferens (IVD) insertion. Five rats of the control group were also sham operated and treated post-operatively with terramycin as the other groups. Sperms were collected from the mid portion of copper IVD area and also from the two device free areas (d.f.a) i.e. at the urethral and epididymal ends of the vas deferens for morphological examination. The different regions of the vas deferens were then processed for determination of copper. The tissues were dried in an oven at 500°C (approx. in Muffle's furnace) for 12 hrs then ashed at 50°C for 8 hrs. The ashed samples were dissolved in 0.4 *ml* concentrated hydrochloric acid and the volume was made upto 25 *ml* with distilled (mineral free) water.

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The copper ions were analysed with a Beckman Model 495 Atomic Absorption Spectrophotometer. The precision of the technique was assessed by analysing replicates and determinng the percentage recoveries. The recovery was 95-99% with a detection limit of 0.1 ppm (3).

RESULTS

At 2 days, concentration of copper in the copper IVD area (Cu-IVD) of the vas deferens were significantly higher than those of the two other device free areas (d.f.a), ($P < 0.01$; Table I). As compared to 2 days, the copper content at 7 days was considerably reduced in Cu-IVD ($P < 0.01$). This was followed by a gradual decline in copper content during an observation period of 28 days (Table I and Fig. 1). Microscopic examination of the spermatozoa from the

TABLE I: Showing release of copper by a copper intra-vas device in the vas deferens of male rats.

Segments	A		B		C	
	Total wt. of vas tissue taken for cu-release (mg)	*Free area (urethral end) µg/day*	*Total wt. of vas tissue taken for cu-release (mg)*	*Cu-IVD area µg/day*	*Total wt. of vas tissue taken for cu-release (mg)*	*Free area (epididymal end) µg/day*
Control+	20.0	0.04	20.0	0.03	20	0.035
2 days	20.0	0.50	20.0	4.0	20	1.00
7 days	40.0	0.43	32.0	1.7	24	0.58
14 days	20.0	0.25	20.0	1.06	40	0.58
21 days	24.5	0.22	16.5	0.85	46	0.54
28 days	40.0	0.20	15.0	0.67	52	0.40

\+ Copper content at 0 days

* Date pooled for 5 animals with copper intra-vas device.

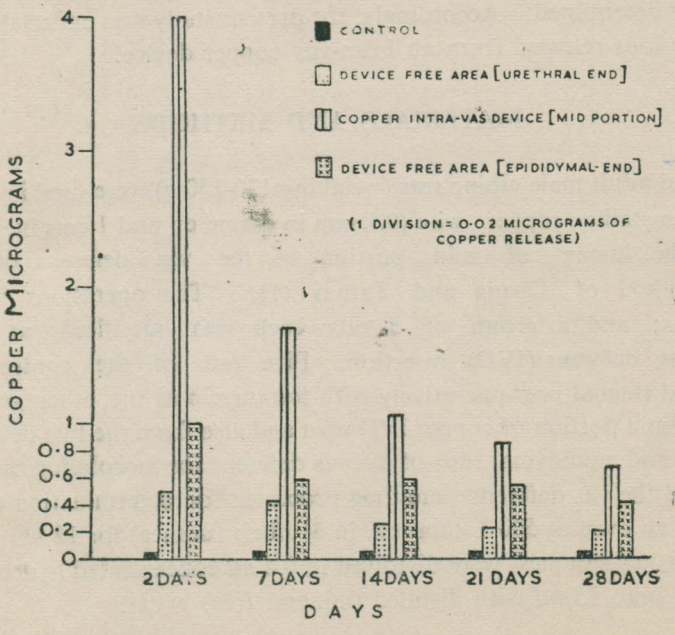

Fig. 1: Garaph showing release of copper from a copper-intra vas device.

copper-IVD and device free area (d.f.a.) near the urethral end showed cent percent decapitation at all time intervals; sperms from the device free area (d.f.a.) of the vas deferenc near the epididymal end were, however, normal at all time intervals.

DISCUSSION

Loewit (5) has reported that 1.5% CuCl caused complete immobilization of human spermatozoa in 5 minutes, whereas, lower concentrations need a latent period of 2-4 hours to achieve this effect. The present *in vivo* study shows that 4 micrograms of copper is released from intra-vasal copper device in rats, which with the pace of time releases less of copper i.e. only 0.67 μgm in 28 days groups. Thus it appears that in the long run it acts only as a mechanical device to achieve antifertility effect. Mechanisms of action of Cu-IVD which can be presumed to work at such a low concentration of copper may not be showing a spermicidal effect, but affecting sperm motility and fertilizability by altering vasal fluid milieu or replacement of zinc with copper in sperm head (4) or simply as a mechanical device. Pertinently this device has been reported to affect fertility in male rats (7). The present study indicates that *in vivo* e[illegible] micro amount of copper is sufficient to induce temporary sterliity in rats. Work on other related species are indicated.

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