Study of the sperm immobilizing action of furacin

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Abstract

Introduction: Semen is not azoospermic immediately after vasectomy. Accidental conception after surgery can ruin the popularity of a sterilization programme and also marital relations. It has been found that furacin can be used to immobilize sperm and hence cause sterilization.
Material and methods: We studied sperm immobilization with furacin in 20 human adult men in the age group 25 to 45 years. Also, the vas deferens of 12 sexually mature male guinea pigs were irrigated with furacin on one side and normal saline on the other side to rule out tissue toxicity. Histological sections of vas of both sides were prepared and compared.
Results: In the semen samples of healthy adult males, with furacin concentration of ≥0.4 mg/ml sperm were found to be immotile in all the fields in 5:1 dilution at 37°C. The histological sections of vas deferens of guinea pigs also revealed no evidence of any inflammatory response.
Conclusions: Thus it was observed that furacin has the ability to immobilize sperm in certain concentrations and is nontoxic to the vas deferens of guinea pigs. The use of furacin as a post-vasectomy flush can be recommended to ensure early and complete contraception.

Key words: aspermia, furacin, nitrofurazone, sperm, vas deferens, vasectomy.

Introduction

The aim of the present study was to observe the role of furacin on the ability to immobilize sperm in certain concentrations and to test its non-toxic nature to vas deferens of guinea pigs. Perhaps the results of the study would spell out the importance of furacin as a post-vasectomy flush and that it could be recommended to ensure early and complete contraception.

It has been reported that semen is not azoospermic immediately after vasectomy [1]. Post-vasectomy aspermia occurs only after a period ranging from 3 to 6 months, usually after 30 to 40 ejaculations, and the usual advice after vasectomy is to use contraceptives for 3 months. Few cases of lingering non-motile sperm post-vasectomy, not due to re-canalization of the vas deferens, have been reported [2]. The importance of early aspermia after vasectomy is particularly significant in an over-populated country like ours. The rate of clearance is influenced by factors like age of the person and frequency of ejaculations [3]. Besides there being few facilities for a regular sperm count, it is difficult to convey to illiterate patients the importance of contraception required after surgery. Accidental conception after surgery can ruin the popularity of the sterilization programme and also spoil marital

relations. It has been suggested [4] that the patient should obtain "clearance" in order to avoid unwanted pregnancy in the immediate post-operative period. Attempts have been made to render the semen sperm free in the immediate post-vasectomy period by vas irrigation with water and furacin by a few workers [5, 6].

Chemically furacin is 5-nitro-furaldehyde semi-carbazone. It probably acts by interfering with glucose and pyruvate metabolism especially in bacteria [7]. It has the capacity to immobilize sperm when used at a certain critical concentration, and is nontoxic to the vas deferens.

Recent studies have shown that the probability of furacin damaging the germ cells by causing hormonal imbalance is extremely low, since there is no pattern of hormonal imbalance that could be regarded as the cause of testicular degeneration [8].

Material and methods

Sperm immobilization: in vitro study

Study Group

Twenty human adult men of the age group 25 to 45 years were selected for the study. Consent was taken for the study. Semen was prepared by standard swim-up technique as per WHO description criteria. Their semen ejaculates were collected in test tubes and incubated at 37°C with furacin solution in varying concentrations from 0.1 mg/ml to 0.5 mg/ml. After time intervals of 5, 10, 15, 20 and 30 min the percentage of motile sperm was counted under the light microscope, in 10 fields for each specimen.

Control Group

In this group, spermatozoa of the same individuals as of the study group were incubated with normal saline and similarly processed. The results from the two groups were compared.

Tissue toxicity: in vivo study

Twelve sexually mature male guinea pigs of an average weight of 700-900 g were selected. Proper ethical clearance was obtained from the Institutional Ethical Committee and the experiments were performed. Under ether anaesthesia, the left scrotal area of each animal was shaved and painted with savlon. A linear vertical incision 3 cm long was made in the upper part of the scrotum and subcutaneous tissue was separated. The vas deferens was isolated between two 3-0 catgut ligatures. A fine incision was made on the vas with a scalpel. With the help of a paediatric catheter the vas was irrigated in the distal as well as the proximal direction with the furacin solution in a concentration three times greater than was necessary to obtain sperm immobility in vitro, i.e. 2 ml of 0.4 mg/ml. The vas was divided and both the ends were anchored to the perivasal tissue to be identified later by 2-0 catgut. The incision was closed with cotton thread using interrupted sutures. As a control, on the contralateral side, the vas was divided, irrigated with normal saline and anchored in the same manner.

At intervals of 1, 2, 3, 4 and 6 weeks the guinea pigs were sacrificed by excess of chloroform inhalation and their vas deferens were completely dissected out on both the experimental and control side. The vas was cut at two levels 1 cm apart in the flushed distal and proximal segments. These tissues were fixed in 10% neutral formal saline, and blocks were prepared for study of sections stained by haemotoxylin and eosin, under a light microscope.

Results

Sperm immobilization experiment

Sperm motility was observed in the group where furacin was used in varying concentrations of 0.1 to 0.5 mg/ml. Sperm motility was observed to be 10 to 50% with furacin concentrations of 0.1 to 0.3 mg/ml during the 5-30 min range, whereas with concentrations of ≥0.4 mg/ml sperm were found to be immotile in all the fields in 5:1 dilution at 37°C. The control group revealed no loss of motility during the same intervals.

Tissue toxicity

Histological sections of proximal and distal segments of the vas deferens on the study side of three guinea pigs each at 1, 2, 3, 4 and 6 weeks consistently showed no inflammatory response. The furacin solution used was three times more concentrated than was necessary to gain sperm immobilization in vitro. There was no evidence of any inflammatory response in the soft tissues of the vas in any the specimens, as judged by lack of any disruption of mucosal lining or cellular infiltration of the sub-mucosa.

Discussion

In previous studies a great deal of variation has been reported in clearance of spermatozoa after vasectomy. Some researchers [9] have reported 95% azoospermia at 16 weeks, whereas others [10] on a study of 1000 men observed that 14.3% had lingering sperm between 6 to 18 months after vasectomy. A precise explanation of events leading to azoospermia after vasectomy is not available. In a fluoroscopic study [11] it has been reported that there is regurgitation of sperm from the ejaculatory duct into seminal vesicles at the time of ejaculation. Furthermore, it was postulated [12] that irrigation of the vas deferens acts by opposing the natural mucosal adherence by immobilizing sperm, rather than producing a mechanical flushing of sperm or lysis.

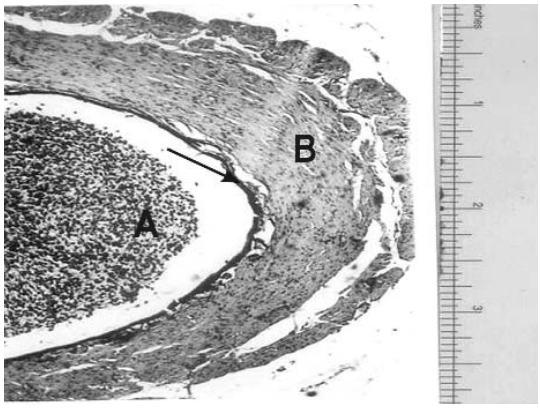

Figure 1. Histological micrograph of (distal part of the vas deferens) control in 1 week after irrigation with saline solution only, showing: A – sperm, B – muscle layer. The mucosa lining the lumen is shown with an arrow (10×). No changes of inflammation are observed as regarding disruption of mucosal lining

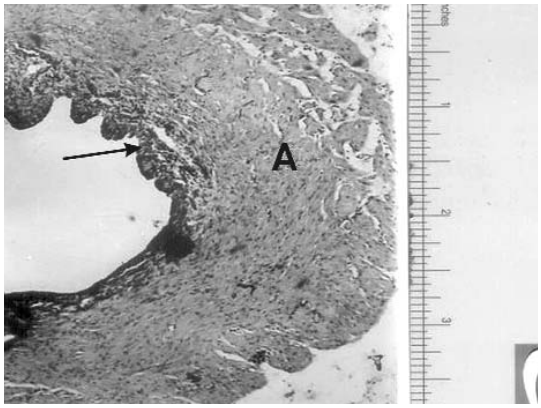

Figure 2. Histological picture (10×) of post-operative 1 week, showing the muscle layer – A; the mucosa lining the lumen is shown with an arrow

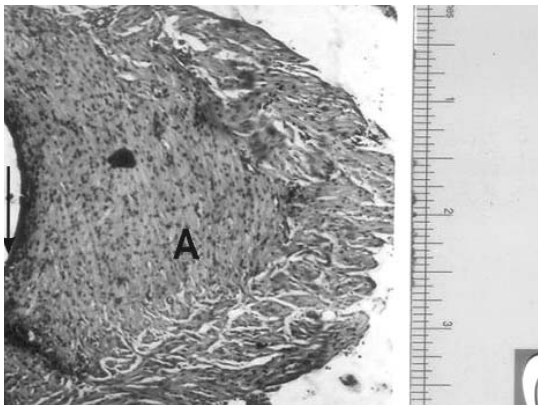

Figure 3. Histological picture (10×) of vas deferens of control at 5 weeks showing: A – muscle layer (showing no changes of disruption of mucosal lining). The vas deferens mucosa lining the lumen is shown with an arrow

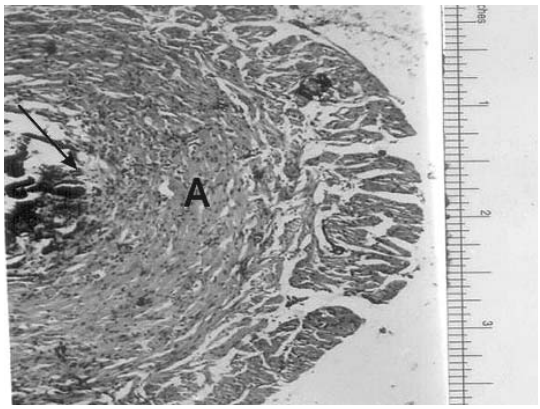

Figure 4. Histological picture (10×) of post-operative 5 weeks, showing: A – muscle layer. The mucosa lining the lumen is shown with an arrow

In the present study, we observed that furacin can cause sperm immobilization when used in certain critical concentrations of ≥0.4 mg/ml in 1:5 dilution. We do admit that a thorough check of the reversibility of the phenomenon would have been better. A future study in this regard may be planned to look into this effect. Furacin is also non-toxic to the vas deferens when used in concentrations more than necessary to achieve an immobilizing effect. The margin of safety of the dosage was considerable, as shown by absence of inflammatory effects on the vas deferens with concentrations up to 3 times the effective dose. The anti-inflammatory effect of furacin is a well known fact, as is evident from some past research studies [13]. This corroborates the findings of another author [14], who used the same drug as chosen by us. A recent study demonstrated the fact that furacin in the dose of 64 mg/kg body weight per day (which is higher than our dose), for 10 and 20 days, may cause toxicity in the testes of mice [15]. The toxicity of furacin may be dose-related.

Our study depicts that furacin can safely be used as an intra-operative flush to ensure rapid disappearance of sperm and for sterility in the immediate post-vasectomy period. We speculate that furacin acts as an agent to interfere with spermatogenesis, thereby causing resultant symptoms. In the present study, we have used furacin to achieve sterility both in vitro and in vivo. The absence of changes of inflammation, i.e. disruption of the mucosal lining, may be considered as a positive finding. This is evident in Figure 2 and 4, where the mucosal lining is intact.

We do agree that some research studies have stressed the fact that immediate sterility cannot be guaranteed by vas irrigations, although in most

cases this procedure may hasten the onset of sterility, and post-vasectomy semen examinations are still needed [16].

We opine that after vasectomy non-motile sperm do not cause pregnancy. Absence of motile sperm in a post-vasectomy assay gives sufficient assurance of sterility, provided a fresh specimen is examined and non-motile sperm can be disregarded. Although additional work is needed to evaluate the utility of sperm-immobilizing agents and the mechanism of sperm adherence, it remains an attractive option for accelerating sperm clearance.

In conclusions, based on the facts of our study, we opine that furacin can be used as an intra-operative one-time flush post-vasectomy to ensure sterility in the immediate postoperative period. Henceforth, the follow-up of these operated cases is made easy and abstinence is also not required. It could thus contribute towards the success of the national family planning programme.

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