THE HUMAN VAS-ITS LUMEN IN RELATION WITH AGE AND NEUROMUSCULAR TRANSMITTERS

S. R. GUPTA, G. S. CHHINA AND K. R. SUNDARAM
Department of Physiology,
*All India Institute of Medical Sciences, Ansari Nagar, New Delhi-*110016

Summary: Specimens of human vas deferens were obtained during elective surgery under local analsthesia. The internal diameter of the vas lumen was measured by means of set of rods of 0.10 mm diameter increments. These measurements were made within 5 minutes of the removal of vas and noted as control values. The effect of its immersion in epinephrine 1/10000, nor-epinephrine 1/1000 and acetylcholine 1/1000 on diameter of lumen was determined. The mean diameter of vas lumen in saline was 0.83±.09 mm in subjects of 29 to 32 years age and 0.89±.009 mm in subject of 33 to 48 years. This value was significantly lower in subjects of 49 to 52 years (0.69±.06 mm). The lumen diameter decreased significantly in response to epinephrine and nor epinephrine and increased when the vas was immersed in acetylcholine. The response of vasal smooth muscle as indicated by alteration of lumen size was significantly lower in subjects of 49 to 52 years of age to epinephrine and acetylcholine. It has been proposed that diameter of the vas at different age groups and its responsiveness to neuromuscular transmitters may be taken into consideration when designing vas occulsive devices.

Key words: human vas vas lumen response to neuromuscular transmitters

INTRODUCTION

As the popularity of vasectomy has increased for fertility control so also the need for its reversal has grown slowly. The approaches to reversibility include vas anastomosis and use of vas-occlusive devices which are effective for contraception and permit reversal. In the latter approach plugs, clips, intravasal threads and valves have been considered. The tap like, rotary and stop cock type valves have been developed and evaluated in adult monkeys, and the stop cock variety was found to be fairly effective (6).

An ideal vas occlusive device must completely block the vas and be easily and completely reversible and involve only a minor surgical procedure for its installation (1). The vas lumen therefore becomes an important factor for the effectiveness of the device and any alteration of the lumen in changing physiological and pathological states needs to be assessed.

For this purpose, the lumen of the vas removed from 100 vasectomy cases covering a wide range of age was measured by the method described earlier by Brueschke *et al.* (2). The changes in the lumen were assessed in response to neuromuscular transmitters; epinephrine, norepinephrine and acetylcholine. In addition the relation of the diameter to different age groups and responsiveness of vas to neuromuscular transmitters were studied.

MATERIALS AND METHODS

Vasa were obtained from 100 subjets operated at a vasectomy camp held in New Delhi. Their age ranged from 29 to 52 years. They were arbitrarily divided into three groups according to their age. Subjects from 29 to 32 years of age formed group I; from 33 to 48 years formed Group II and from 49 to 52 years formed Group III.

1 to 2 cms long piece of vas was excised bilaterally from 2 cms above the upper pole of testis. Its internal diameter was measured with the help of a set of measuring rods, within 5 minutes of its removal from the body. During this period the vasa were immersed in normal saline at 37°C. This measurement was considered to be a control lvaue of the lumen of a particular vas. The rod shaped gauges were of diameter increments of 0.1 mm and were inserted with 'no resistance' described by Brueschke *et al.* (2). The force used was assessed by the spring balance method described by Kuckuck *et al.* (6) and found to be of 1 to 2 g level. Some of the vasa studied were histologically examined and absence of damage to mucosa was confirmed.

Any change in the diameter of lumen after immersing in a testing solution at 37°C for 5 minutes was recorded. The solutions used were:

(a) epinephrine (1/10000)
(b) nor-epinephrine (1/1000) and acetylcholine (1/1000) respectively. The vas piece was rinsed in 3 changes of normal saline for a total period of 10 minutes before immersing into another testing solution.

RESULTS

The mean diameter of the vas lumen ±S.D. at different age groups is shown in Table I.

TABLE I: Mean internal diameter ∓ Standard deviation of vas lumen of subjects at different age groups.

Age group	*Number of subjects*	*Mean age ±S.D. (years)*	*Mean weight ±S.D. (kg.)*	*Mean internal diameter of vas ±S.D. (mm)*
I. (29-32)	10	30.4±1.27	41.2±2.55	0.83±0.09
II. (33-48)	70	40.6±3.55	51.0±1.93	0.89±0.09
III. (49-52)	20	50.6±1.15	45.6±2.78	0.69±0.06

This value was 0.83±.09 mm at age group I 0.89±0.9 mm at age group II and 0.69±.06 mm at age group III. Statistically there was no significant difference between the values observed in group I and II ($P > 0.05$) but significant difference was found between group I and III and between groups II and III ($P < 0.01$).

The vas lumen decreased after immersal in epinephrine and nor-epinephrine, but increased when immersed in acetylcholine. The mean ± standard deviation of the change of lumen diameter in response to neuromuscular transmitters and the results of statistical tests of significance are shown in Table II.

The diameter of the vas lumen decreased in all three groups significantly after immersal in epinephrine. It decreased after immersal in nor-epinephrine also, but significantly so only in group II. In acetylcholine, the vas lumen increased in comparison with its respective control value, but this increase was significant only in Groups I and II.

TABLE II: Mean±standard deviation of the change of lumen diameter at different age groups in response to neuromuscular transmitters.

Age group	*Epinephrine*	*Nor-epinephrine*	*Acetylcholine*
I	−0.07±0.04**	−0.02±0.08	+0.11±0.09**
II	−0.13±0.07***	−0.04±0.07***	+0.03±0.07***
III	−0.06±0.06***	−0.01±0.04	+0.01±0.06

− denotes decrease + denotes increase **P<0.01 ***P<0.001

The response of vas, in form of decrease or increase, to different solutions tested was statistically analysed in relation with age groups. The results showed that there was no significant association of the response with age groups, in nor-epinephrine. In epinephrine and acetylcholine there was a significant association of the response with age groups of the subjects. The difference in the percentage of subjects with a change in diameter value was significant between groups II and III in both these solutions (P 0.001).

DISCUSSION

The mean vas lumen has been reported to be 0.85±0.07 mm when the measuring guages were inserted with no resistance (2). Our values obtained from group II are : closely in agreement (0.89±0.05) with these figures. The internal diameter of the vas reported earlier differs from these because of the 5 g force level used for insertion of the measuring guage (6) instead of insertion with no resistonce.

The mean diameter of the vas lumen in the older groups (49-52 years) was significantly lower when compared to the age group I (29-32) and II (32-48). Hardly any studies have related the vas lumen, with age and weight of the donor. Stanwood, *et al.* (10) have recently reported on the sizes of lumen internal and external diameter of vas in vasectomised sub-

jects. The mean internal diameter of the vas on the urethral side (distal) was found to be 1.03± .20 mm, while that of the testicular side was much larger. This higher value on the distal side could be the result of decreased tone because of the distruption of innervation to the distal vas by surgical manouvres during vasectomy (9).

The human vas is no more considered to be a passive conduit for passage of sperms. The study of its ultra structure demonstrates the complexity of lining epithelium (5) while the histochemical studies have revealed a sparse innervation which is predominently adrenergic in nature (3). Ventura (11) proposed that rythmic contractions of the vas during ejaculation were dependant on the integrity of sympathetic innervation, and were mediated by the release of nor-epinephrine from nerve endings. The alteration of the vas lumen in response to neuromuscular transmitters, although not reported earlier, is expected. Hideo Mitsuya *et al.* (4) demonstrated that during ejeculation, the vas lumen alters in size. The contractions of isolated vas in response to epinephrine and nor-epinephrine are suggestive of the important role these neuro muscular transmitters may play during ejaculation.

These responses are found to be depressed by general anaesthesia and low temperature. In the present study local anaesthesia had been used and the vas lumen decreased in response to nor-epinephrine and epinephrine, showing that the anaesthesia that may have infilterated had not prevented the response to catecholamines. Happerlein *et al.* (3) demonstrated that dose response relationship of vas with nor epinephrine was not affected by the age of the donors but our data showed that responses to epinephrine and acetylcholine were lower in vasa obtained from the age group III than in those from group II. Possibly response to sympathetic discharge of nor-epinephrine remains unaltered with age but tone and response to epinephrine and acetylcholine is diminished as age advances. The increased vas lumen after immersion in acetyl choline suggested decreased contractile activity and is opposite to stimulatory effects reported by Martin *et al.* (7) as well as no change observed by Mcleod *et al.* (8). However, the cholinergic component has been histochemically identified and may be playing a role through mechanisms as yet, not identified.

Vasectomy results in thinning of the testicular end of the vasal wall resulting in increased lumen size without alteration of the outer diameter (10). A vasocclusive device could damage the lining epithelium under increased pressures from rythmically contracting occluded vas during ejaculation. Possibly a compliable device with a diameter lower than that of the vas lumen is likely to be effective for occlusion during ejaculation and permit reversal when necessary. It is proposed that evaluation of the vas lumen at different age groups and responsiveness of vas to neuromuscular transmitters may be taken into consideration when designing vas occlusive devices.

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