

SOME PROBLEMS OF INFERTILITY IN SINGAPORE*

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In Singapore at this time when emphasis is being placed on Family Planning and Population Control, it must become desirable that the problem of infertility is not lost sight of, for this problem must be second only in importance to that of self-preservation.

Ever since man acquired the art of transmitting his thoughts to written words, references to this subject had already been alluded and recorded. Much had been written in Biblical times such as the story of Rachel and Jacob, and then through the Hippocratic era to Herophilus and to De Graaf. The discovery of spermatozooids by Ham & Leeuwenhoek in 1677 and the knowledge of their functions by Spallanzani in 1768 were notable advances; and so was Jaggard's theory in 1889 of anovulatory menstruation.

But it is only in the last 50 years that significant progress in this subject has been made and giants to the fore include:—

1. Rubin — 1920 Method of demonstrating Tubal Patency
2. Huhner — 1921 Introduction of the Post-coital Test
3. Meyer — 1913 }
Schroeder — 1928 } The Significance of
Shaw — 1925 } the Menstrual Cycle
Frankel — 1910 }
Novak — 1926 }
4. Wiesner & Crew — 1929 }
Ascheim & Zondek — 1928 } The relationship of
the Pituitary-Ovarian Axis
5. Ogino — 1928 }
Knaus — 1929 } The Theory of
Mid-Cycle
Ovulation

and in the recent two decades, Lane-Roberts, Sharman, Walker and Wiesner 1939, Williams 1944, Meaker 1934, Green-Armytage and Shirodkar have added their knowledge and ideas. With this increasing knowledge, the complexity of this subject becomes more

thoroughly appreciated and the problem thus involves many factors.

INTRODUCTION

This presentation is an analysis of the investigations carried out over the years 1953 to 1956 and covered groups of couples who attended an Infertility Clinic held once weekly by the Professorial Gynaecological Unit at the Kandang Kerbau Hospital. The bulk of the investigations was carried out amongst the non-paying class of patients involving mainly the Chinese population with a sprinkling of the other races as shown below:—

Chinese	— 249	=	80.3%
Indians	— 41	=	13.2
Malaysians	— 13	=	4.2
Others	— 7	=	2.3
Total	310		100.0%

The customs of the people investigated and the local conditions are of importance in this subject. Until recent times in this State when much is being made to equalise the status of women to men and similarly to legalise the principles of the Women's Charter, the status of women has generally been much inferior to that of men. In a great number of the cases investigated, marriage is largely a "business" deal and the code of chivalry is practically non-existent. Amongst the Chinese and the Indian cases, the arranged marriages do not consider love but principally involve financial security, family and sex. Wives in these two communities have been known to have been left behind in India and China for years on end whilst the respective husbands journey to and sojourn in this country to make a living. It is only after obtaining some financial security in this country that such wives are ultimately sent for, and then the task of reproduction begins in earnest. It is the impression that the majority of the women who have been investigated have little or no sex-instruction and pre-marital or extra-marital sex experience is unusual amongst them. There would thus appear to be a need and scope for the

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establishment of a Pre-Marital Clinic in this State.

The Chinese community is particularly notorious on the problem of secondary wives for it is the primary duty of a Chinese wife to get a child and preferably a male child. Failure as such would provide the husband an excuse to secure a second wife with sometimes complete alienation of relationships from the first wife.

TYPES OF INFERTILITY AND LENGTHS OF INFERTILITY

There has been generally much confusion over the question of terminology. In this series under investigation, adherence is made to the classification of Lane-Roberts et al (1939) which clearly defined infertile conditions as follows:—

Primary Sterility — defined as sterility or infertility occurring in a marriage of two years in which there has been no known conception.

Secondary Sterility — defined as a marriage in which there has not, for 3 or more years, been born a viable child but in which one or more conceptions have occurred.

Absolute Sterility — implies the presence of an absolute bar to conception in either partner.

Relative Sterility — implies the presence of no absolute bar to conception but that there are one or more responsible factors.

Even in this terminology of Lane-Roberts et al, perhaps the attachment of sterility is not appropriate for in the ordinary mind it would imply an inability rather than incapacity to reproduce, and rather a more appropriate terminology would be infertility rather than sterility.

In this series under review, absolute sterility and relative sterility are not classified, for these two definitions are open to much criticism as so much depends on the interpretations of the individual observers.

A total of 310 patients had been seen and assessed and the types of infertility are as follows:—

Type	Chinese	Indians	Malays	Others	Total	%
Primary	177	32	6	1	216	69.6
Secondary	72	9	7	6	94	30.4
	249	41	13	7	310	100.0

A breakdown of the duration of years that each type of infertility is involved is similarly seen in the following table:—

Type	2-3 yrs.	4-5 yrs.	6-7 yrs.	8-9 yrs.	Over 10 yrs.
Primary	68	34	34	31	49
Secondary	9	10	10	10	55
	77	44	44	41	104

Although there is a great proportion of gynaecologists who would advocate that an infertile couple need no investigations if they had been married less than 2 years, it would seem judicious under present circumstances to examine all couples and all patients who voluntarily come forward for assessment even though recently married. It would appear that what may have been omitted in the pre-marital clinic, investigations can be carried out after marriage, and the causes, if any, ascertained. In our State, a total of 121 patients (39%) had been infertile for varying periods under 5 years before they sought attention. 85 patients (27%) were infertile for periods from 6 to 10 years and 104 patients (34%) had been infertile for over 10 years.

In the 4 years under review, a total of about 16,000 patients had attended the Gynaecological clinic of the Professorial Unit and only 310 patients (1.9%) had been assessed for infertility. This must not be taken to mean that the incidence of this problem is correct, for the existence of this clinic had not been much publicised and there would have been many who through ignorance or shyness would not indicate that they wished to be examined for infertility. It is the opinion that the true incidence of infertility as an entity amongst the population at large is certainly 4 or 5 times higher than this survey showed, for one must remember too that the gynaecological out-patients of this hospital are open too, to the many cases who have anything else but gynaecological ills.

PROBLEMS RELATED TO HISTORICAL DATA

Menstrual Histories:

Menarche

The average Singapore girl of any race may be said to experience menarche at an average of 13.5 years. The Malaysians

and the Tamils appear to commence their menstruation much earlier — possibly 1 year earlier, perhaps because they are indigenous to the tropics. Of the 310 patients assessed, 6 could not remember the age of their menarche and the remaining patients showed a distribution as follows:—

	10-13 yrs	14-17 yrs	Over 17 yrs
Primary Infertility	34	153	26
Secondary „	21	62	8
	55	215	34

A total of 249 patients (82%) would thus appear to have a delayed menarche, assuming that we accept the average age of menarche of the average Singapore girl as 13 years. Delayed menarche applies to both the primary and the secondary infertile groups.

Cycle

A normal menstrual cycle is considered to have a variation ranging from 21 days to 35 days. The flow should usually be moderate averaging 2 to 3 vulval pads and should last no more than 5 days. Discomfort may be experienced and pain of dysmenorrhoea should be absent.

Of the 310 cases seen, abnormal variations were noticed as follows:—

	Primary	Secondary	Total
Duration —			
less than 21 days	12	2	14
Duration —			
more than 35 days	15	6	21
	27	8	35

There were 6 cases complaining of primary amenorrhoea and 15 cases gave a history of oligomenorrhoea.

Polymenorrhoea and menorrhagia or menometrostaxis were encountered as complaints in investigations of the history in 14 cases.

It would thus appear that infertile women have a greater tendency towards a lowered menstrual function as amenorrhoea and oligomenorrhoea than in excessive function such as polymenorrhoea and menometrostaxis. A sum total of 42 patients (13.6%) of the total seen, showed this tendency of hypo-function and 14 (4.4%) that of excessive function — 3 times greater an amount.

Dysmenorrhoea

A normal menstrual period may be accompanied by discomfort but where this discomfort gives way to pain and incapacity, and makes the individual concerned fear the onset of the next period, then dysmenorrhoea results. Spasmodic dysmenorrhoea appeared more common in the primary type of infertility although in both the congestive type of dysmenorrhoea predominated.

A total of 143 patients (46.1%) complained of dysmenorrhoea being of higher incidence amongst the primary infertile group (122 cases) than amongst the secondary infertile group (22 cases).

This history of dysmenorrhoea was volunteered and in a great number of cases (84 cases or 27%) it constituted the main complaint which brought the patient to the gynaecological clinic and not infertility per se.

Other Primary Complaints:

Dyspareunia

This complaint of painful intercourse did not figure prominently in this series of cases under review. Only 7 cases (2.2%) attended the clinic because of this symptom. It is common knowledge that modesty and shyness makes this complaint a difficult one for presentation. It is the experience that most of the time it is the husband who makes this complaint on behalf of the wife, who even when directly questioned will not admit this aspect of marital maladjustment.

The 7 cases with this symptom were all in the primary group.

Anxiety Neurosis

The psychological factors in infertility have received considerable attention in both American and European literature. They are, however, insignificant in West and East Africans although it has been reported that contact with Western civilisation and Christianity had introduced psychological barriers amongst them and psychic complaints would thus be bound to increase. In Singapore in this series under review, a total of 119 patients (38.4%) attended the clinic with the primary complaint of "Anxious to have a child". Only 23 patients in the secondary group offered this as a presenting symptom when attending the clinic and the remaining 96 patients in the primary group attended the clinic with this anxiety neurosis

either coerced to do so by anxious mother-in-law or because there is commencing strain in husband and wife relationship. It has been explained earlier that the problem of secondary wives is of importance amongst Chinese couples and prolonged infertility in the primary wife may occasion an opportunity for the husband to seek another for purposes of procreation.

Leucorrhoea and Vaginal Discharges

A total of 28 patients (9%) offered these symptoms as part of the primary complaints.

Whilst it must be accepted that "whites" may sometimes be normally excessive as in periods of ovulation, the 28 patients assessed had pathological vaginal discharges made up as follows:—

Gross Cervical Erosion	-	-	6 cases
Vaginal Trichomoniasis	-	-	16 cases
Vaginal Moniliasis	-	-	4 cases
Trichomoniasis and Moniliasis	-	-	2 cases
			28 cases

These conditions are naturally inimical to spermatozoa and are factors therefore of great significance in treatment. The problem of moniliasis has now been well taken care of with the advent of Mycostatin (Nystatin) but trichomoniasis remains a problem in the sense that to date nothing in use appears to completely eradicate and cure the condition although many claims have been made.

Previous Abortions

A total of 50 cases (16.1%) in the secondary infertile group gave a history of episodes of previous abortions. The significant aspects of this part of the history amongst these 50 patients are as follows:—

Septic abortions	-	-	6 cases
Criminal abortions	-	-	12 cases
Habitual abortions	-	-	8 cases
Associated with curettage	-	-	16 cases
Spontaneous abortions			
without curettage	-	-	12 cases
			Total
			50 cases (16.1%)

Perhaps the most tragic cases involve those associated with sepsis and in those who for

one reason or another had to resort to deliberately removing their previous pregnancy. A total of 36% of cases as such were involved and it would appear that prognosis for them is very unfavourable, for tubal anatomy and/or tubal function in these cases will be naturally greatly disturbed. In some of them even correction may not bring on fruitful results.

Dilatation and curettage in 32% of post-abortual infertiles appeared to account for the secondary infertility. The mode and manner of this disturbance could not be completely ascertained but in some cases of recurrent or habitual abortions, authorities have shown that an incompetent cervical os induced by vigorous dilatation of the cervix can give rise to an incompetent cervical os syndrome. This is associated with the QPC syndrome of Green-Armstrong in which the abortion that occurs is one which is Quick, Painless and Complete.

In recent years, Shirodkar of Bombay has described his cervical circumsture operation for such cases and success of his method has been widely reported. An incompetent cervical os may of course have a complete plastic repair such as the Last & Last method of repair but caution must be enjoined in such operation in the sense that restoration of competency may bring on disturbed cervical function as to interfere with subsequent chances of conception.

A habitual abortion describes one who has experienced two or more episodes of abortions.

PROBLEMS RELATED TO CLINICAL DATA

Uterine Factors

The uterus is the important end-all organ in the whole complex of conception. Disturbances of any form in this organ will either be a bar to conception, or if conception did occur, it might not allow successful nidation and for pregnancy to proceed normally.

(a) Genital hypoplasia in general is universally accepted of importance in infertility, but the difficulty, except in gross cases, is the practical evaluation of their significance. The American School (Lawrence & Howe 1928, Rowe 1930) consider hormonal assay an important part in this analysis but this is not generally shared for these procedures are costly and technically difficult to be of practical value as a routine.

Varying incidences have been cited by varying authors on genital hypoplasia as follows:—

Feiner 1942	-	-	-	-	5.2%
Meaker 1934	-	-	-	-	42.0
Kandang Kerbau Hospital	-	-	-	-	19.0

In this series under review 2 main types of hypoplasia have been emphasized and 59 cases or 19% of the cases were found to have hypoplasia as follows:—

Stigmata of Hypoplasia (Green-Armytage)	-	-	-	33 cases
Helicoid Uterus (Sheares)	-	-	-	26 cases

In the case of the Green-Armytage standardisation, three or more of the following stigmata constitute a case of Hypoplasia:—

1. Narrow introitus with a history of difficult intromission.
2. Vagina — The posterior wall is short and the fornix shallow. The upper third of the canal is constructed as by a band or is "tented".
3. Cervix — Small, button-hole or conical or with hexagonal-like margins.
4. Uterus — Light, acorn-like, small, acutely anteflexed or retroflexed — the "Peter Pan" uterus.
5. Pelvic Diaphragm — Thin and flabby, permitting easy descent of the uterus and cervix to the level of the introitus.
6. Tubes — Long, tenuous and tortuous. Spastic.
7. Ovaries — Insensate to bimanual examination.
8. Girdle — Obesity and "Frankel" pads over the ilium.
9. Hair — Male or infantile pubic escutcheon with hairy backs of thighs or front of legs.

The Sheares standardisation of the helicoid uterus is one which is hypoplastic and spirally deviated to one side of the mid-line. 26 of the 310 cases investigated showed this feature.

(b) Other uterine factors —

In this series under review, other uterine pathology which were detected were constituted as follows:—

Utero-Vaginal Prolapse	-	6 cases
Proven TB Endometritis	-	1 case
Uterine Fibromyomata	-	4 cases
Adenomyosis	-	8 cases
Total		19 cases (6%)

The incidence of TB Endometritis does not appear to be consistent with figures by other authorities, but it is possible that figures here are very much lower because of our laboratory and bacteriological handicaps. The cases of adenomyosis were suspect on routine examination and could only be confirmed at laparotomy.

Tubal Factors

Investigations on the question of tubal patency were carried out in this series both by tubal insufflation in the first place and subsequently by Hystero-salpingograms on cases that were found to be non-patent by insufflation.

There were 155 cases that were found to have negative tubal patency by insufflation, and after hystero-salpingographic studies, blocked tubes were found in 37 cases (11.9%) — 21 of these were in the primary infertile group and 16 in the secondary infertile group.

The causes of the tubal blockage could not be definitely ascertained but certainly in all cases under review, the problem of pelvic inflammatory disease was associated. This incidence is compared with other workers as follows:—

Kandang Kerbau Hospital	-	-	11.9%
Meaker 1934	-	-	14.0
Green-Armytage 1934	-	-	14.0
Feiner 1942	-	-	35.0
Sharman 1944	-	-	38.0

Ovarian Factors

Studies on this factor were limited in this series to endometrial biopsy studies which were carried out preferably in the third week of the menstrual cycle. No doubt this form of study has its drawback and perhaps there is scope in future for the use of vaginal smears to ascertain whether a menstrual cycle is featured by ovulation or otherwise. Of course it must be accepted that it is not uncommon for women to have one or two anovulatory cycles per calendar year.

A total of 21 cases or 6.6% of the cases investigated showed features of anovulation and comparing with other authorities, the figures are as follows:—

Kandang Kerbau Hospital	-	-	6.6%
Novak 1934	-	-	5-10.0%
Green-Armytage 1934	-	-	
Rock, Bartlett & Matson 1939	-	-	4.0%

PROBLEMS RELATED TO THE MALE FACTORS

A total of 304 male patients attended for assessment in this series under review but 44 patients subsequently dropped out for one reason or another, and could not be included in the findings. On the basis of seminological assays and taking only the totally infertiles in consideration, a total of 80 patients (30%) were considered to be responsible for the infertile state. When compared with other authorities, this figure would appear to be almost identical, thus confirming, the universal opinion that in general, the male partner is responsible for 30-40% of cases in infertility.

Kandang Kerbau Hospital	- - -	30%
Whitehouse 1935	- - -	25%
Meaker 1934	- - -	30%
Crossen & Crossen 1941	- - -	39%
Sharman 1944	- - -	31.6%

(a) Racial Distribution of the Males investigated:

Chinese	- - -	209 cases
Malaysians	- - -	12 cases
Indians	- - -	38 cases
Eurasians	- - -	1 case

(b) Age Distribution:

20 to 30 years	143 cases =	55.0%
31 to 35 years	86 cases =	33.1%
36 to 40 years	16 cases =	6.1%
Over 40 years	15 cases =	5.8%
Total	260 cases	100.0%

(c) Historical Data:

History taking amongst the male patients obtained positive and relevant points as follows:—

- (1) Coincident Pulmonary Tuberculosis - - - - 5 cases
- (2) Past History of Malaria with Quinine Therapy - - - - 53 cases
- (3) History of Venereal Exposure 63 cases
- (4) History of Venereal Disease with Positive Serological Test 24 cases
- (5) Moderate to Severe Alcoholism 12 cases

The cases with Pulmonary Tuberculosis had suppressed seminal counts and in all of them,

intercourse had been infrequent and haphazard. The male patients themselves had no desire to beget children and had merely attended on pleadings of the wife. From a clinical point of view, Pulmonary Tuberculosis per se should not render a patient infertile except in cases where tuberculous epididymo-orchitis might be a complication.

It had been thought possible that cases who have had intensive quinine therapy at some stage in their lives, might have their fertility suppressed in the sense that seminal assays will show a sub-fertile count. 53 such cases were listed who have had quinine therapy and only 4 cases were aspermics and 12 cases had a sub-fertile count—an apparent and relative 30% of cases. This is of doubtful statistical value.

Sixty-three cases (24.2%) of the cases assessed admitted a history of venereal exposure and 24 cases (9.2%) had definite venereal disease both gonorrhoea, buboes and chancre. All the 24 cases claimed they had been adequately treated but investigations of the wives found that 9 cases were serologically positive. Gonorrhoea is definitely more causative of pelvic inflammatory disease and blocked tubes are certainly mainly caused by gonococcal infection.

A total of 12 cases admitted they were heavy drinkers and were frequently drunk. Such cases had haphazard periods of sexual intercourse and in most of the cases, the wives had a disinclination at the times that the husbands were not sober.

(d) Clinical Data:

Examination of the genitalia of the male patients disclosed varying abnormal conditions as follows:—

Phimosis	- - -	9 cases
Undersized Phallus	- - -	10 cases
Atrophic Testes	- - -	9 cases
Inguinal Herniae	- - -	7 cases

It is difficult to make any definite conclusions from the above findings. Certainly an undersized phallus would imply failure of erection and therefore impotence, which was the case in the 10 cases under review. There appears to be scope for artificial insemination for such cases if the seminal assays were within normal

limits. The 9 cases of atrophic testicles were found on seminal assays to be cases with aspermia and although testicular biopsy would have disclosed the nature of the atrophy, this method of investigation was not used in this series under review. Inguinal herniae were coincidentally found in 7 cases and these cases showed merely sub-fertile seminal assays, and was the case with those with phimosis; no definite conclusions could be drawn from this relationship.

(e) Seminal Assays:

The standard that was employed to assess fertility on basis of seminal assays is as follows:—

- Volume — Average 4 ml. (Range 3 to 7 ml.).
- Sperm Count — Average 40 millions per ml. At least 60% should show normal shape and motility at the time of examination.

Of the 260 cases assessed, a total of 84 cases (30%) were associated with aspermia and 32 cases (12%) had subnormal counts. It would have been fruitful, as mentioned earlier, to have had all the 84 cases subjected to testicular biopsies but because of lack of facilities and more important because very few of the patients would agree to this method of investigation, the procedure was not insisted upon in this survey. Normal testicular biopsies would have meant blockage in the Vas Deferens and certainly in some cases the site may be demonstrated and overcome.

SUMMARY AND CONCLUSIONS

1. A brief survey of the historical data on the progress of infertility is made.
2. A total of 310 cases of female patients and a total of 304 male patients were assessed at an Infertility Clinic held weekly by the Professorial Gynaecological Unit at the Kandang Kerbau Hospital for the years 1953 to 1956. These cases and their analyses form the subject matter of this presentation of Problems of Infertility in Singapore. Statistically the incidence of infertility would appear to be about 1.9% but it is felt that the true incidence of infertile patients attending the Gynaecological Clinic must be in the region of 6 to 7% because attendances at the Gynaecological Clinic have been known to cater for many cases other than gynaecological ills.
3. The Chinese populace constitutes 80% of the cases analysed and essentially this study is mainly amongst this community. The customs and local conditions of these people investigated have been given importance in the introduction paragraph. There appears to be a need for establishment of a Pre-marital Clinic.
4. The terminology of Lane-Roberts et al (1939) was closely followed in this analysis and 69.6% of the cases were of the Primary Group and 30.4% of the cases in the Secondary Group. Absolute and Relative Sterility as terminology were not classified because of the difficulty on the interpretations by individual observers.
5. 39% of the cases had been infertile for varying periods under five years before seeking attention. 27% waited for periods from 6 to 10 years and 34% of the patients had been infertile for a period of over 10 years before coming to the clinic.
6. Some problems related to historical data that appear of importance are cited:—
 - (a) Menarche —
If the average age of menarche for the average Singapore girl is taken as 13.5 years, a total of 82% of the patients assessed was found to have a delayed menarche.
 - (b) Cycle-Periodicity —
Hypo-function as exhibited by amenorrhoea and oligo-menorrhoea was three times over the total of cases with polymenorrhoea and menometrostaxis which was only 4.4%.
 - (c) Dysmenorrhoea —
A total of 46.1% of the cases seen had dysmenorrhoea and in 27% of the cases, the complaint had been so severe as to be listed as the main and primary complaint when first attendance took place at the clinic.
 - (d) Dyspareunia —
Only 2.2% of the cases attended with this complaint but attention is drawn to the shyness and modesty as peculiar characteristics of the population as a

whole, and this makes this complaint a difficult one for presentation.

(e) Anxiety-Neurosis —

A total of 38.4% of the cases showed this symptom complex both from the interviews and subsequent investigations.

(f) Leucorrhoea and Vaginal Discharge —

A total of 90% of the cases showed pathological vaginal discharges as caused by gross cervical erosion, trichomoniasis and/or moniliasis.

(g) Previous Abortions —

A total of 16% of the cases chiefly amongst the secondary infertile group gave a history or histories of previous abortions. The significant types are those associated with septic or criminal abortions and those with previous dilatations and curettages. The importance of the relationship of an incompetent cervical os with habitual abortion as caused by a vigorous dilatation of the cervix is stressed.

7. The assessment of the clinical data gave rise to important problems as follows:—

(a) Uterine Factors —

A total of 19% of the cases investigated showed the stigma of hypoplasia as adjudged by the Green-Armytage standards and of the standard of the Sheares helicoid uterus. This is compared with other authors.

Other uterine factors total 6% and were made up of Utero-Vaginal Prolapse, Proven TB Endometritis, Fibromyomata and Adenomyosis.

(b) Tubal Factors —

A total of 11.9% of the cases showed evidences of blocked tubes both by tubal insufflation and confirmed by hysterosalpingograms. Tubal insufflation alone, however, demonstrated non-patency in 50% of the cases analysed, and this method of investigation alone would appear to be quite unreliable.

This ratio is similarly compared with other series.

(c) Ovarian Factors —

Studies on these factors involved mainly on the establishment of ovulation as seen by endometrial biopsies. A total of 6.6% of the cases seen had this

factor associated. This figure is also compared with other series.

8. Problems related to the male counter-parts were similarly presented.

Historical data:

(a) Racial Breakdown —

The Chinese community constituted 80% of the cases analysed.

(b) Age Distribution —

55% of the cases were from ages 20 to 30 years. 33.1% of the cases were from ages 31 to 35 years. 6.1% of the cases were from ages 36 to 40 years. 5.8% of the cases were from ages over 40 years.

(c) Significant problems amongst the male partners analysed included histories of Pulmonary Tuberculosis, Malaria with Quinine Therapy, Venereal Disease and Venereal Exposure and also Alcoholism. But no definite conclusions could be reached from the results except to say that about 3% of the cases with Venereal Disease did cross-infect their respective spouses.

Clinical Data:

(a) Pathological Genitalia —

A total of 14% of the male cases seen showed evidence of Phimosis, undersized phallus, atrophic testes and inguinal herniae. One-fourth of this total, with atrophic testes, had aspermia.

(b) Seminal Assays —

The normal range and standard of this study is recorded and a total of 30% of the cases had aspermia. 12% had sub-normal counts, but not much significance was attached to this finding. The total of 30% constituted definitive male responsibilities and this was compared with reports from other series. There, however, appears to be scope for testicular biopsy studies which was not included in the present series as a method of investigation.

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