

## STRUCTURAL ABERRATIONS OF 'Y' CHROMOSOME IN AZOOSPERMIC MALES

Gajanan Laxmanrao Maske <sup>1</sup>, Archana Damdharrao Kannamwar <sup>\*2</sup>.

Assistant Professor, Department of Anatomy, Shri. V. N. Government Medical College, Yavatmal, India.

Associate Professor, Department of Anatomy, Shri. V. N. Government Medical College, Yavatmal, India.

### ABSTRACT

**Background:** Male factor infertility is a distressing condition that adds to the psychological trauma to majority of couples. Infertility affects about 15% of all couples attempting pregnancy, with male factor identified in approximately half the cases. One of the major contributing factors of failure of sperm production in testis is genetic disturbance. This can be seen either at chromosomal level or at gene level. Chromosomal abnormalities, numerical or structural can occur in somatic cells (mitotic), testicular germ cells (meiotic) or spermatozoa (gametic).

**The context and purpose of the study:** 30 non-obstructive Azoospermic infertile males from Acharya Vinoba Bhave Rural Hospital, Sawangi (Meghe), Wardha, were selected for present study. From each subject 3 ml venous blood was collected in a sterile bulb with the help of preheparinized syringes. Chromosomal analysis was carried out by conventional as well as Giemsa Trypsin Giemsa (GTG) technique in cytogenetic laboratory, Department of Anatomy, J. N. Medical College, Sawangi (Meghe), Wardha. For each subject, total 25 metaphases i. e. 15 conventional and 10 G-banded metaphases were analyzed. In cases with chromosomal abnormalities, total 45 metaphases i. e. 25 conventional and 20 G-banded metaphases were studied. Selected metaphases were photographed using CCD camera.

**Results:** Structural aberration of 'Y' chromosome was found in 2 subjects. In both these subjects, the 'q' arm of 'Y' chromosome was long (46, XYq+) as compare to chromosomes of 'F' group. The total percentage of 46, XYq+ in present study comes to 6.67%. This was confirmed by G-banding.

**Conclusions:** 2 subjects (6.67%) were detected with long 'q' arm of 'Y' chromosome (46, XYq+) which compares favorably with literatures on the same subject.

**Potential implications:** Assisted method of reproduction was an option of treatment for infertile males. The same study could be combined with molecular genetic studies to ascertain the chromosomal anomalies at molecular level and thereby proper counseling could be given to infertile couples. This can be of vital role in planning of parenthood.

**KEY WORDS:** Azoospermia, Metaphase, Y Chromosome, q' arm.

**Address for Correspondence:** Dr. Archana Damdharrao Kannamwar, Shri. V. N. Government Medical College, Yavatmal.445001. India. **E-Mail:** [drgajananlmaske@gmail.com](mailto:drgajananlmaske@gmail.com)

### Access this Article online

#### Quick Response code



DOI: 10.16965/ijar.2016.486

**Web site:** International Journal of Anatomy and Research  
ISSN 2321-4287  
[www.ijmhr.org/ijar.htm](http://www.ijmhr.org/ijar.htm)

Received: 22 Nov 2016  
Peer Review: 22 Nov 2016  
Revised: None

Accepted: 20 Dec 2016  
Published (O): 31 Jan 2017  
Published (P): 31 Jan 2017

### INTRODUCTION

Male factor infertility is a distressing condition

that adds to the psychological trauma to majority of couples. Infertility affects about 15% of

all couples attempting pregnancy, with male factor identified in approximately half the cases [1].

Available literatures in the Indian scenario suggest 3-9% infertility [2,3], amongst the married couples of India. The defects in male partners play equal role as that of female partner in causation of infertility [4].

One of the major contributing factors of failure of sperm production in testis is genetic disturbance. This can be seen either at chromosomal level or at gene level. Chromosomal abnormalities can occur in somatic cells (mitotic), testicular germ cells (meiotic) or spermatozoa (gametic). In either of these it could be numerical or structural, involving either sex chromosomes or autosomes [5].

Chromosomally derived infertility has long been recognized. Literatures on chromosomal studies of infertile males show up to 13.7% abnormalities in azoospermic subjects [6]. The defects are particularly localized to long arm of Y chromosome which leads to variable disturbances to spermatogenesis [7].

In this study, we have studied chromosomal abnormalities in azoospermic males with the help of karyotyping, conventional and G-banded metaphases.

## MATERIALS AND METHODS

30 non obstruction Azoospermic infertile males from AVBR Hospital, Sawangi (Meghe), Wardha (MS) were selected for present study. These subjects were referred for chromosomal analysis after medical checkup to rule out genital tract obstruction, varicocele, hernia, genital tuberculosis, pulmonary & extra pulmonary tuberculosis, venereal diseases, Endocrinal disorders and abnormal testicular biopsy.

Written consent was obtained from each subject and 3 ml venous blood was collected in a sterile bulb with the help of preheparinized syringes. Chromosomal analysis was carried out by conventional as well as Giemsa Trypsin Giemsa (GTG) technique in cytogenetic laboratory, department of Anatomy, Jawaharlal Nehru Medical College, Sawangi (Meghe), Wardha.

All slides were screened first under low power objective of microscope and then under oil immersion

objective. For each subject, total 25 metaphases i.e. 15 conventional and 10 G-banded metaphases were analyzed. In cases with chromosomal abnormalities, total 45 metaphases i.e. 25 conventional and 20 G-banded metaphases were studied. Selected metaphases were photographed using CCD camera.

## RESULTS AND DISCUSSION

On Cytogenetic analysis of 30 azoospermic infertile subjects structural aberration of 'Y' chromosome in the form of 46, XYq+ was found in 2 subjects. The total percentage of 46, XYq+ in present study comes to 6.67% (Table 1).

**Table 1:** Chromosomal abnormalities in present study.

Seminal feature	No. of subjects	Subjects with Normal karyotype (46, XY)	Subjects with 46, XYq+	Abnormality (%)
Azoospermia	30	28	2	6.67

### a) Conventional method:

**Table 2:** Observations of conventional method.

No. of cases	Conventional karyotype	%
	Structural aberration	
2	Long 'q' arm of Y chromosome	6.67

Two subjects had a chromosomal count of 46 and shows long 'q' arm of Y chromosome in all the metaphase studied. Length of Y chromosome was more than chromosomes of group 'F' in both the subjects. This was confirmed by G-banding (Table III). Remaining 28 (93.33 %) subjects had normal chromosomal count of 46, XY in all the metaphases.

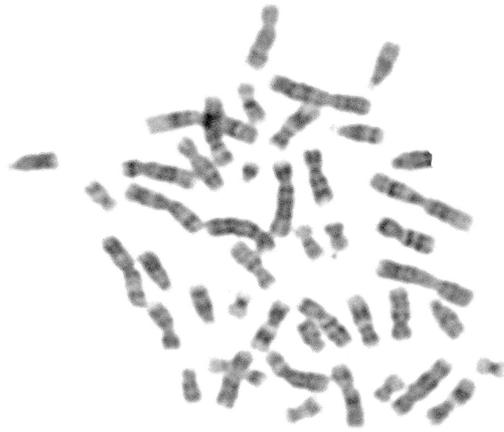
**a) GTG Method:** The findings of conventional method were confirmed by G-banding.

**Table 3:** Observations on G-banding.

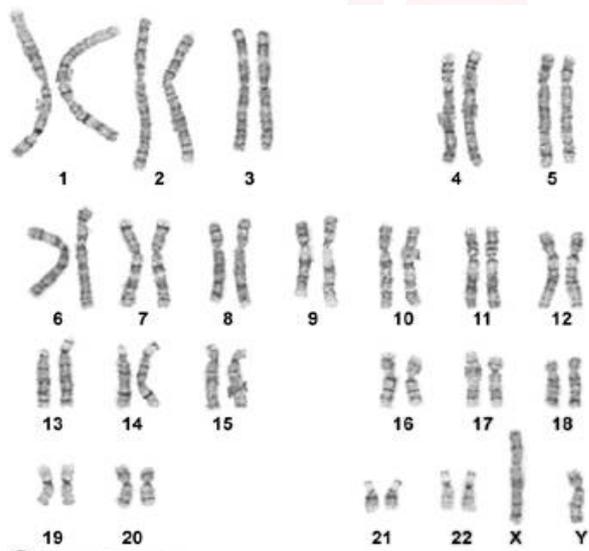
No. of cases	G Banded karyotype Structural aberration	karyotype
2	Diffuse dark band on terminal portion of 'q' arm of 'Y' chromosome	46,XYq+

In two subjects, 'Y' chromosome showed diffuse dark band on terminal portion of 'q' arm which differentiate it from other chromosomes of 'G' group. This structural abnormality was confirmed as long 'q' arm of 'Y' chromosome (fig.1 & 2).

**Fig. 1:** Metaphase spread of 46, XYq+.



**Fig. 2:** Karyotype of 46, XYq+.



**DISCUSSION**

In the present study an attempt has been made at rural hospital level to find out structural aberrations of 'Y' chromosome in azoospermic infertile males. They were referred from AVBRH Sawangi (Meghe), Wardha after medical and surgical check-up to rule out any obstructive esions in the reproductive tract. Semen analysis of the subjects were done before they were referred for chromosomal analysis. The criteria to call a subject as azoospermic was according to guidelines recommended by WHO [8].

The structural chromosomal aberration detected in present study was long 'q' arm of 'Y' chromosome with the karyotype 46, XYq+. The criteria to call 'q' arm of Y as long, was based on the guidelines of Nielsen and Friedrich, 1972, according to which when ratio of length of Y and chromosomes of F group was equal to or more

than 1, it was considered as long Y chromosome (Y/F e" 1 '! Yq+) [9].

**Table 4:** Percentage of infertile cases with 46, xyq+ in different studies.

Reported by	No. of cases with 46, XYq+	%
Court Brown et al (1967) [19]	4/207	1.93
John Philip et al (1970) [11]	Jan-98	1.02
Koulischer & Schoysman (1974) [14]	4/200	2
AC Chandley et al (1975) [16]	20/1599	1.25
H Muller et al (1975) [20]	4/182	2.2
WF Hendry et al (1976) [13]	13/198	6.56
JJ Peter et al (1980)	3/102	2.94
L Abramsson et al (1982)	9/342	2.63
Tarnekar et al (2002) [18]	Mar-60	5
<b>Present study</b>	<b>Feb-30</b>	<b>6.67</b>

L Abramsson et al (1982), found 16 cases of Yq+ amongst 342 infertile males (2.63%) and John Philip et al (1970) found 1 case of Yq+ amongst 98 males (1.02%) [10,11]. Both had placed this karyotype in the group of major chromosomal abnormalities. In present study the 'q' arm of Y showed an enlarged terminal heterochromatin in 3.33% subjects. PK Ghosh (1979) opined that enlargements of heterochromatin were potential factors in causing errors in meiosis, especially during X-Y pairing and segregation [12]. Hendry et al (1976) has demonstrated many abnormalities in such subjects [13]. Koulischer and Schoysman (1974) kept such karyotypes as 'abnormalities of unknown significance' [14].

In other studies the percentage of Yq+ cases amongst male infertile cases was: JJ Peter et al (1980) 2.94%, AC Chandley et al (1975) 1.255%, W.F. Hendry et al (1976) 6.56%, L Abramsson et al (1982) 2.63%, M Micic et al (1984) 3.29%, Koulischer and Schoysman (1974) 2% and Tarnekar et al (2002) 5%. In present study, total 2 cases of 46, XYq+ karyotype amongst 30 azoospermic subjects (6.67%) were found [10,13-18].

The percentage of cases with 46, XYq+ increased when subjects with sperm counts below 20x10<sup>6</sup>/ml were selected. JJ Peter et al (1980) 3.1%, W.F. Hendry et al (1976) 8.02%, L Abramsson et al (1982) 3.44% and present study 3.33% [10,13,15]. There was wide difference ranging between 1.02% - 6.67% in number of Yq+ cases

in various studies. Since the percentage of Yq+ cases increased with lowering sperm count, the percentage of Yq+ cases differed in different studies according to selection criteria of cases.

In a study of randomly selected males, Court Brown et al (1967) reported 1.93% cases of Yq+, while in a large scale study on new born male population, H Muller et al (1975) found 2.2% cases, showing the extent to which general male population might carry 46, XYq+ karyotype [19,20]. Since present study included only azoospermic subjects with infertility, the occurrence of 6.67% cases with this karyotype warrants such cases to be judged with caution before considering them as normal variants and of no significance [19].

Tiepolo and Zuffardi (1976) in a study of azoospermic subjects by C and Q banding techniques, showed partial deletion of 'q' arm of Y chromosome in 6 individuals [21]. They suggested that factors controlling spermatogenesis (later called as azoospermic factors 'AZF') might be located on euchromatic (non-fluorescent) portion of 'q' arm of Y. After these findings, Y chromosome has been the focus of most of the genetic studies. It is noteworthy that enlarged heterochromatic segment of Y (C-band positive and brilliantly fluorescent in Q-banding) is very close to these azoospermia factors.

Cytogenetic studies of infertile males suggest that the chromosomal aberrations do formulate a basis of disturbed spermatogenesis. At times the biochemical process of spermatogenesis is faulty because of an abnormal gene product. Such cases are being increasingly detected with molecular genetic methods such as Polymerase chain reaction (PCR) and 'fluorescent in situ hybridization- FISH' etc. Genes controlling spermatogenesis have been located on 'q' arm of Y chromosome [7,22].

Several non genetic factors play a role in disturbing the process of spermatogenesis in testis. Hormonal imbalances, exposure to toxic chemicals, ionic radiations, heat exposure, cytotoxic medications and sometimes psychosocial factors have also been identified amongst such factors [23].

28 of 30 (93.33%) subjects did not show any structural chromosomal abnormalities. However prolonged exposure to heat has been inculcated

as a cause of infertility in people working in metal, glass and ceramic industries and those in sedentary jobs requiring prolonged sitting (drivers, computer operators etc.).

## CONCLUSION

2 subjects (6.67%) were detected with long 'q' arm of 'Y' chromosome (46, XYq+) which compares favorably with literatures on the same subject.

Assisted method of reproduction was an option of treatment for infertile males. But because of possibilities of chromosomal abnormalities in such cases the specialist undertaking procedures like ICSI, should investigate such subjects properly, including Cytogenetic studies. The same study could be combined with molecular genetic studies to ascertain the chromosomal anomalies at molecular level and thereby proper counseling could be given to infertile couples. This can be of vital role in planning of parenthood.

The methods section should include the design of the study, the type of materials involved, a clear description of all comparisons, and the type of analysis used, to enable replication.

**Conflicts of Interests: None**

## REFERENCES

- [1]. Ken McElreavey, Csilla Krausz. Male infertility and Y chromosome. *American Jr of Hum Genet* 1999; 64:928-933.
- [2]. Singh Amarjeet, Dhaliwal L K and Kaur Arvinder. Infertility in a Primary Health Centre of North India: A follow-up study. *The Journal of Family Welfare* March 1996;42(1):51-56.
- [3]. Hargreave T B. In- The management of male infertility. P. G. Publishing Pte. Ltd. Singapore, 1990;1-5.
- [4]. Okabe M, Ikawa M and Ashkenas J. Gametogenesis '98. Male infertility and the genetics of spermatogenesis. *American journal of human genetics* 1998;62:1274-1281.
- [5]. de Krester D M. Male infertility. *The lancet* 1997;349:787-790.
- [6]. Assche E, Bonduelle M, Tournaye H, Joris H, Verheyen G, Devroey P, Steirteghem A and Liebaersl. Cytogenetics of infertile men. *Human Reproduction* 1996;2(Suppl. 4):1-24.
- [7]. Elreavey K M, Krause C and Bishop C E. The human Y chromosome and male infertility. *Result and Problem in Cell Differentiation* 2000;28:211-232.
- [8]. WHO. Laboratory manual for the examination of human semen and sperm-cervical mucus interaction. IV Edition, Cambridge University Press, UK, 2000.

- [9]. Nielsen J and Friedrich U. Length of Y chromosome in criminal males. *Clinical Genetics* 1972;3(4):281-285.
- [10]. Abramsson L, Beckman G, Duchek M and Nordenson I. Chromosomal aberrations and male infertility. *The Journal of Urology*, July 1982;128:52-53.
- [11]. Philip J, Skakkebaek N E, Hammen R, Johnsen S G and Rebbe H. Cytogenetic investigation in male infertility. *Acta Obstetrica Gynecologica Scandinavica* 1970;49:235-239.
- [12]. Ghosh P K. Chromosome heteromorphism in children with congenital malformation. *Indian Journal of Experimental Biology* November 1979;17:1186-1189.
- [13]. Hendry W F, Polani P E, Pugh RCB, Sommerville I F and Wallace D M. 200 infertile males: correlation of chromosome, histological, endocrine and clinical studies. *British Journal of Urology* 1976;47:899-908.
- [14]. Koulischer L and Robert Schoysman. Chromosomes and human infertility. I. Mitotic and Meiotic chromosome studies in 202 consecutive male patients. *Clinical Genetics* 1974;5:116-126.
- [15]. Peter JJ, Vaidya R A, Rege N R, Gokarn V V, Phadke A G and Ambani L M. Cytogenetic abnormalities in male infertility. *Indian Journal of Medical Research* February 1980;71: 225-231.
- [16]. Chandley A C, Edmond P, Christie S, Gowans L, Fletcher J, Frackiewicz A and Newton M. Cytogenetics and infertility in man. I. Karyotype and seminal analysis. Results of a five-year survey of men attending a sub fertility clinic. *Annals of Human Genetics*, London 1975;39:31-252.
- [17]. Micic M, Micic S and Diklic V. Chromosomal constitution of infertile men. *Clinical Genetics* 1984;25:33-36.
- [18]. Tarnekar A, Anbalgan J, ghosh S, Fulzele R, Pal A. Cytogenetic study of azoospermic men. *Perspective in cytology and genetics* 2004;11:443-447.
- [19]. Court- Brown W M, Jacobs P A and Brunton M. Chromosome studies on randomly chosen men and women. *The lancet* Sept 1965:561-562.
- [20]. Muller H, King H P and Glasser M. Chromosome polymorphism in a human newborn population. II. Potentials of polymorphic chromosome variants for characterizing the ideogram of an individual. *Cytogenetics and Cell Genetics* 1975;15:239-255.
- [21]. Tiepolo L and Zuffardi O. Localization of factors controlling spermatogenesis in the nonfluorescent portion of the human Y chromosome long arm. *Human Genetics* 1976;34:119-124.
- [22]. Foresta Carlo, Moro Enrico and Ferlin Alberto. Y-Chromosome micro deletions and alterations of spermatogenesis. *Endocrine Reviews* April 2001;22(2):226-239.
- [23]. Sharpe R M. Life style and environmental contribution to male infertility. *British Medical Bulletin* 2000;56(3):630-642.

**How to cite this article:**

Gajanan Laxmanrao Maske, Archana Damdharrao Kannamwar. STRUCTURAL ABERRATIONS OF 'Y' CHROMOSOME IN AZOOSPERMIC MALES. *Int J Anat Res* 2017;5(1):3389-3393. DOI: 10.16965/ijar.2016.486