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CASE REPORT

A Case of Balanced Complex Chromosome Rearrangements of Four Chromosomes Accompanied with Oligospermia and Asthenospermia

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ABSTRACT

Background: **Complex chromosomal rearrangements (CCRs) refer to a chromosomal structural abnormality involving three or more chromosomes and having at least three breakpoints. Male carriers are prone to sperm formation disorders and face a higher probability of adverse pregnancies.**
Methods: **Peripheral blood lymphocyte cultures and G-banding karyotype analysis were conducted on the patient and his parents.**
Results: **The results of the peripheral blood karyotype analysis of the patient were 46,XY,t(5;19;6;9) (9pter→9p13::5p13→5qter;19pter→19q13.3::5p13→5pter;6pter→6q12::19q13.3→19qter;5qter→5p13::9p13→9pter).**
The karyotype of the mother's peripheral blood showed the same balanced rearrangements as her son, indicating that the chromosomal structural abnormality of the son was of maternal origin.
Conclusions: **BCCRs can interfere with normal chromosomal pairing and distribution during meiosis, resulting in abnormal gametes. For patients with such chromosomal abnormalities seeking healthy offspring, strict prenatal diagnosis or assisted reproductive technologies should be adopted to prevent the birth of children with chromosomal diseases.**
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KEYWORDS

complex chromosomal rearrangements, chromosome, oligospermia and asthenospermia, karyotype

INTRODUCTION

Complex chromosomal rearrangement (CCR) is a rare chromosomal structural abnormality. CCRs frequently involve concomitant breakage, insertion, or inversion events, with the majority representing de novo genomic rearrangements [1]. CCRs may be classified as either balanced or unbalanced, and they can also be de novo or inherited in a familial pattern. Carriers of balanced CCRs exhibit only a positional alteration of the translocated segments while maintaining a normal gene dosage, typically resulting in a phenotypically normal presentation [2]. However, during meiosis, the balanced translocation chromosomes and their homologous counterparts undergo synapsis and recombination [3]. There-

fore, balanced CCR is typically identified either when reproductive issues arise or following the birth of a child born with congenital malformations. Donker et al. [4] indicate that approximately 1.2% of infertile men diagnosed with oligospermia or azoospermia are carriers of a balanced translocation.

We report a case of a male patient with balanced CCRs involving four chromosomes, who also presents with oligospermia and asthenospermia, providing a reference for the clinical diagnosis and genetic counseling of the disease.

CASE PRESENTATION

The patient is a 23-year-old male, who visited the Reproductive Medicine Center of Zhangzhou Affiliated Hospital of FuJian Medical University due to oligospermia and asthenospermia. Physical examination: height 173 cm, weight 64 kg, normal development, with beard, Adam's apple, and normal pubic hair and penis development. Both testicles were of normal size and texture, and no obvious abnormalities were found in the epididymis, vas deferens, and spermatic veins on both sides. Both of the parents are in good health and have one son and one daughter. They have no history of repeated miscarriages.

The patient's peripheral blood chromosome karyotype is 46,XY,t(5;19;6;9)(9pter→9p13::5p13→5qter;19pter→19q13.3::5p13→5pter;6pter→6q12::19q13.3→19qter;5qter→5p13::9p13→9pter) (Figure 1), which belongs to a complex rearrangements involving chromosomes 5, 19, 6 and 9. Cytogenetic analysis of the parents' peripheral blood revealed a normal karyotype in the father, while the mother exhibited the same chromosomal aberration as her son, confirming the maternal origin of the patient's chromosomal abnormality. The karyotype result of the patient's mother's peripheral blood is 46,XX,t(5;19;6;9)(9pter→9p13::5p13→5qter;19pter→19q13.3::5p13→5pter;6pter→6q12::19q13.3→19qter;5qter→5p13::9p13→9pter) (Figure 2), the patient's sister refused to undergo the cytogenetic examination. The chromosomal microarray analysis of the patient's peripheral blood revealed a normal result, indicating that the chromosomal translocation did not cause any gain or loss of genetic material. No deletions were detected in the STS loci of the AZF region or the SRY gene on the patient's Y chromosome. In the assessment of sex hormones, the patient's testosterone, luteinizing hormone, follicle-stimulating hormone, prolactin, and estradiol levels all fall within the normal reference ranges. The semen analysis results are as follows: sperm concentration < 2 M/mL (reference value ≥ 15 M/mL); percentage of grade a + b motile sperm below 32% (reference value a + b > 50%); progressive motility (PR) rate below 27% (reference value PR ≥ 32%).

DISCUSSION AND CONCLUSION

As none of the four abnormal chromosomes, nor any of their four breaking points, occurred in the region between homologous chromosomes, it is certain that the chromosomal mutation took place in an "accidental" incident that happened post-zygote formation and pre-zygote division. Unbalanced ova derived from this complex rearrangements, upon fertilization with normal sperm, yield zygotes with karyotypes exhibiting partial trisomy and partial monosomy involving various combinations of chromosomes 5, 19, 6 and 9 - ultimately leading to infertility, abortion, stillbirth, and early death of malformed off spring [5]. The overall incidence of spontaneous abortion among balanced CCRs carriers is 48.3%, while the rate of adverse pregnancy outcomes reaches 57.3%, which includes an 18.4% incidence of live-born infants with congenital malformations [6]. Theoretically, the probability of a reciprocal translocation carrier giving birth to a normal offspring is very low. However, the clinical experience shows that the risk is lower than the theoretical risk. In this case, the patient's mother, as a balanced CCRs carrier, was still able to give birth to a healthy son and daughter without undergoing prenatal diagnosis or assisted reproduction. Nguyen et al. [7] summarized from previous literature that twenty-seven of the 44 males had spermatogenesis failure or disturbances, the other seventeen having been identified because of repeated abortions or the birth of a malformed child. Male chromosomal balanced rearrangements can interfere with gamete meiosis, leading to cell cycle arrest and spermatogenesis disorders, presenting as oligospermia or asthenospermia [8]. During the development of germ cells, autosomal aberrations can lead to the blockage or partial blockage of meiosis, a reduction in the rate of homologous chromosome exchange during the first meiotic division of primary spermatocytes, an increase in the number of asymmetric bivalents, multivalents and univalents during the zygotene stage, which cause sperm production to be arrested at the spermatocyte level and unable to continue differentiating into sperm, thereby affecting spermatogenic function [9].

It is generally believed that most chromosomal abnormalities related to male infertility occur on sex chromosomes, but abnormalities in autosomes can also cause spermatogenic disorders. Breakpoints on chromosomes 4q, 5q, 7q, 9p, and 14q have been frequently documented in men whose partners experience recurrent abortions. In contrast, breakpoints located on chromosomes 3, 4q, 11q, 12q, and 13q are primarily linked to spermatogenetic failure. However, breakpoints are generally distributed randomly, and no specific breakpoint has been identified to exert a decisive impact on spermatogenetic failure thus far [10].

We believe that one of the important reasons for the patient's oligospermia and asthenospermia is the site effect caused by chromosomal translocation or gene mutations near the breakpoint. It is recommended that the patient

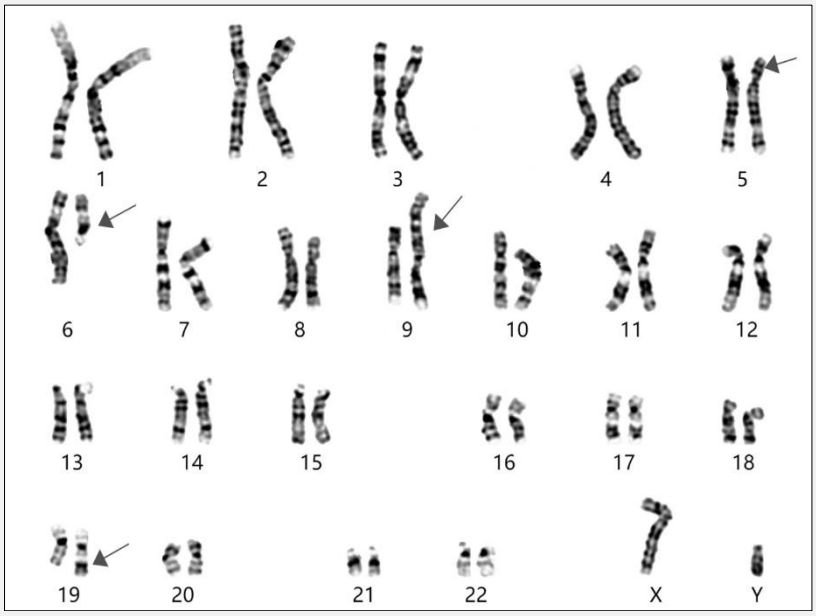


Figure 1. G-banded karyotype of the patient showing chromosomal abnormalities.

Variant regions are indicated by black arrows.

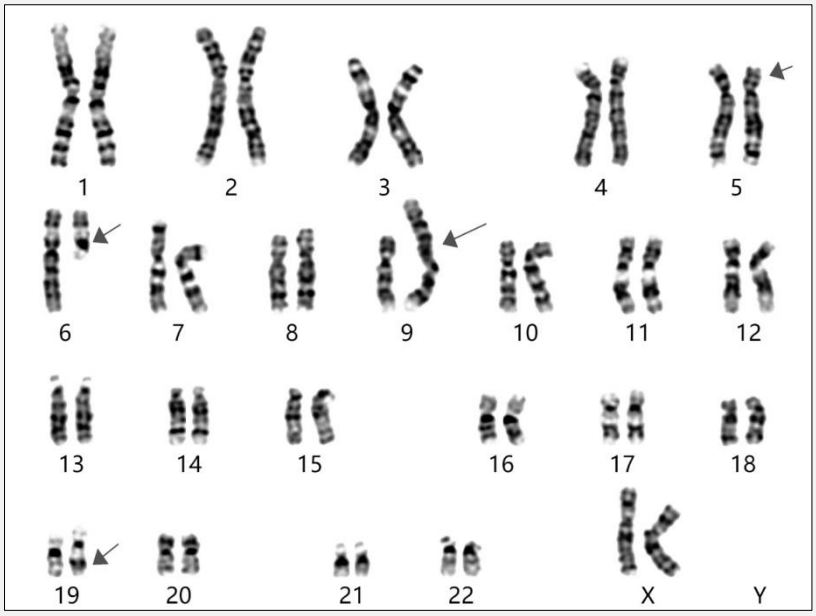


Figure 2. G-banded karyotype of the patient's mother showing chromosomal abnormalities.

Variant regions are indicated by böack arrows.

undergo premarital check-ups, prenatal diagnosis and preconception screening.

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Ethics Approval and Consent to Participate:
This study had been approved by the Institutional Review Board (IRB) of Zhangzhou Affiliated Hospital of Fujian Medical University (2025LWB443).

Consent for Publication:
The patient provided written informed consent for study publication.

Availability of Data and Materials:
The original data and materials presented in the study are included in the article. Further inquiries can be directed to the corresponding author.

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Declaration of Interest:
The authors declare no conflicts of interest.

References:

1. Collins RL, Brand H, Karczewski KJ, et al. A structural variation reference for medical and population genetics. Nature 2020;581 (7809):444-51. (PMID: 32461652)

2. Carvalho CM, Lupski JR. Mechanisms underlying structural variant formation in genomic disorders. Nat Rev Genet 2016;17(4): 224-38. (PMID: 26924765)

3. Chow JFC, Cheng HHY, Lau EYL, Yeung WSB, Ng EHY. Distinguishing between carrier and noncarrier embryos with the use of long-read sequencing in preimplantation genetic testing for reciprocal translocations. Genomics 2020;112(1):494-500. (PMID: 30946890)

4. Donker RB, Vloeberghs V, Groen H, Tournaye H, van Ravenswaaij-Arts CMA, Land JA. Chromosomal abnormalities in 1663 infertile men with azoospermia: the clinical consequences. Hum Reprod 2017;32(12):2574-80. (PMID: 29040537)

5. Madan K. Balanced complex chromosome rearrangements: reproductive aspects. A review. Am J Med Genet A 2012;158A(4): 947-63. (PMID: 22383246)

6. Gorski JL, Kistenmacher ML, Punnett HH, Zackai EH, Emanuel BS. Reproductive risks for carriers of complex chromosome rearrangements: analysis of 25 families. Am J Med Genet 1988;29 (2):247-61. (PMID: 3354596)

7. Nguyen MH, Morel F, Pennamen P, et al. Balanced complex chromosome rearrangement in male infertility: case report and literature review. Andrologia 2015;47(2):178-85. (PMID: 24612408)

8. Rao KL, Babu KA, Kanakavalli MK, Padmalatha VV, Deenadayal M, Singh L. Prevalence of chromosome defects in azoospermic and oligoastheno-teratozoospermic South Indian infertile men attending an infertility clinic. Reprod Biomed Online 2005;10(4):467-72. (PMID: 15901453)

9. Pellestor F, Anahory T, Lefort G, et al. Complex chromosomal rearrangements: origin and meiotic behavior. Hum Reprod Update 2011;17(4):476-94. (PMID: 21486858)

10. Kim JW, Chang EM, Song SH, Park SH, Yoon TK, Shim SH. Complex chromosomal rearrangements in infertile males: complexity of rearrangement affects spermatogenesis. Fertil Steril 2011;95(1):349-352.e3525. (PMID: 20864097)