

EFFECT OF PATERNAL AGE ON EMBRYONIC DEVELOPMENT IN MOTHERS AGED 31-35 YEARS OLD

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Abstract: Most studies on embryo development have considered female factors, and few studies have introduced the influence of paternal age on embryo development. In this study, to explore the influence of paternal age on the development of offspring embryos, women aged 31-35 years old and their husbands aged 22-42 years old were selected from the assisted reproductive cycle. Their eggs were fertilized by intracytoplasmic sperm injection, the normal fertilization rates, normal cleavage rates, effective embryo rates, high-quality embryo rates, blastocyst formation rates of their embryos were statistically analyzed to assess the effects of paternal sperm on embryonic development at different ages. The results showed that for mothers between 31 -35 years old, when fathers were between 28 -36 years old, the embryo development were better, indicating that the sperm quality of fathers in this age group may be the best, and the most conducive to embryo development. When paternal age were more than 36 years old, the normal fertilization rates, effective embryo rates, high-quality embryo rates, blastocyst formation rates all decreased with age increased. This finding suggested that men should have children no later than the age of 36.

Keywords: Embryonic development; Paternal age; Male factor infertility

1 INTRODUCTION

Currently, approximately 10%-15% couples of reproductive age worldwide are affected by infertility[1]. The main factors affecting fertility are environmental factors and parental factors[2]. Among them, the most important factors for both parents are age[3]. Most studies have explored the effect of maternal age on embryonic development, including multicenter studies[4-10]. However, there are fewer studies on the influence of paternal age[11, 12]. Some studies have explored the influence of genetic factors such as sperm genes and chromosomes on the development of embryos, but have not described the influence of sperm from different paternal ages on embryonic development[13]. In addition, there are some studies showed conflicting results[14, 15].

In order to further clearly explore the influence of paternal age on embryo development, this study selected 31-35 years old females which are the main infertility group to explore the influence of their partner's age on the outcome of embryo development. The fertilization method was selected by intracytoplasmic sperm injection, excluding donor patients and patients with less than 3 mature eggs, as well as patients undergoing PGT cycle due to genetic or chromosomal factors. The influence of paternal age on the outcome of embryo development was determined by analyzing five indexes, normal fertilization rates, normal cleavage rates, effective embryo rates, high-quality embryo rates and blastocyst formation rates.

2 RESULTS

2.1 Effect of Paternal Age on Normal Fertilization of Ovum

Among women in 31-35 age group, the fertilization rates of eggs are highest when their husbands aged between 28-30 years old (Figure 1). When fathers older than 30 years old, the fertilization rates of eggs showed a slow decline trend with age increased (Figure 1). The result suggests that the optimal age of fertilization for male sperms may be between 28-30 years old.

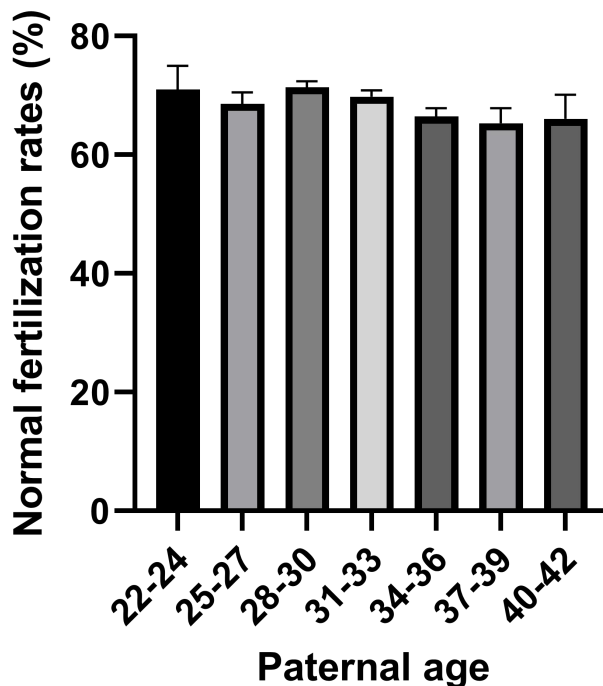


Figure 1 Effect of Paternal Age on Normal Fertilization of Ovum

The influence of paternal sperm from different age group on normal fertilization of eggs was statistically analyzed when the mothers were between 31-35 years old. (22-24, n=26. 25-27, n=117. 28-30, n=364. 31-33, n=390. 34-36, n=192. 37-39, n=65. 40-42, n=31)

2.2 Effect of Paternal Age on Normal Cleavage of Fertilized Eggs

In Figure 2, the results showed that the normal cleavage rates are almost not affected by paternal age. Normal cleavage rates of paternal age between 40-42 years old (95.9032%) are slightly lower than that of other groups, the normal cleavage rates of paternal age between 22-24 years old (97.8846%) are slightly higher than that of other groups, and the overall normal cleavage rates remains above 95% (Figure 2). The result indicates that paternal age had little effects on normal cleavage rates.

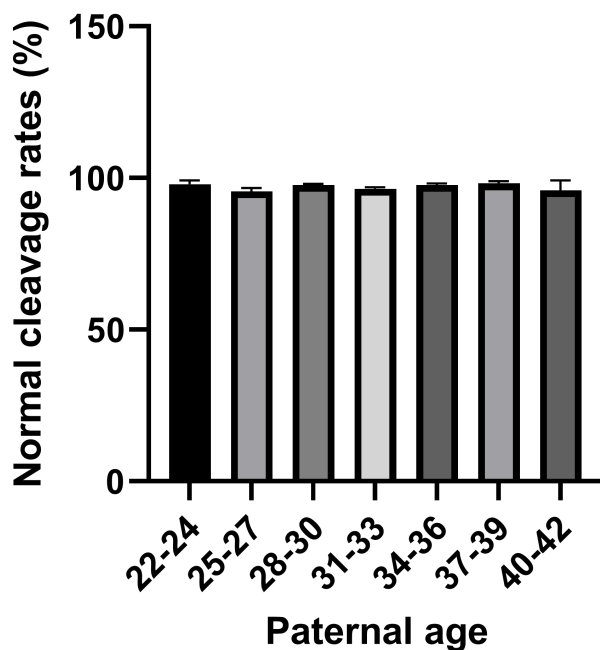


Figure 2 Effect of Paternal Age on Normal Cleavage

The influence of paternal sperms from different age group on normal cleavage of fertilized eggs was statistically analyzed when the

mothers were between 31-35 years old. (22-24, n=26. 25-27, n=117. 28-30, n=364. 31-33, n=390. 34-36, n=192. 37-39, n=65. 40-42, n=31)

2.3 Effect of Paternal Age on Effective Embryo Formation

For paternal age, before 28 years old, the effective embryo rates increased with age (Figure 3). After 30 years, with the increase of age, the effective embryo rates gradually decreased (Figure 3). Although there is a peak of effective embryo rates in male aged 37-39 years old, this may be due to the smaller sample size (n=65) (Figure 3). We speculate that this peak should disappear when the sample size is large enough. This data suggests that the sperms of males aged between 28-30 years old may be most conducive to embryo formation.

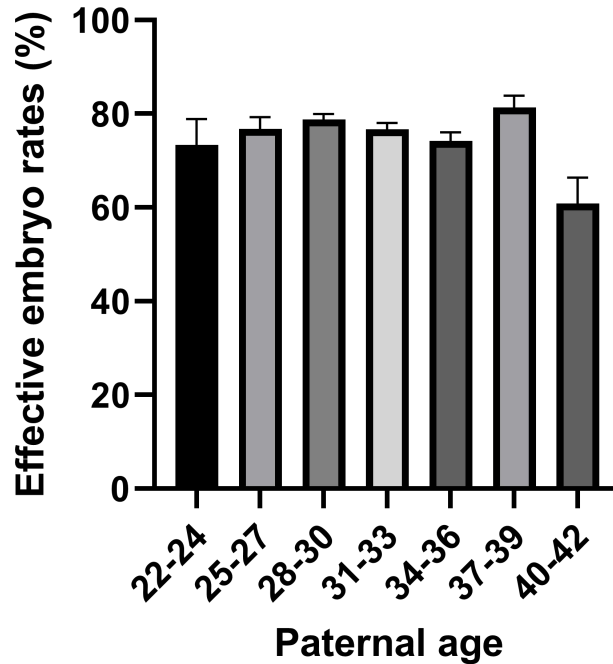


Figure 3 Effect of Paternal age on Effective Embryo Formation

The influence of paternal sperms from different age group on effective embryo formation was statistically analyzed when the mothers were between 31-35 years old. (22-24, n=26. 25-27, n=117. 28-30, n=364. 31-33, n=390. 34-36, n=192. 37-39, n=65. 40-42, n=31)

2.4 Effect of Paternal Age on the Formation of High-Quality Embryos

When paternal ages were younger than 31 years old, the rates of high-quality embryos gradually increased with age (Figure 4). When paternal ages were older than 33 years old, the rates of high-quality embryos gradually decreased with the increase of age (Figure 4). Although the data in figure 4 showed a peak in the rates of high-quality embryos between the ages of 25-27 and 37-39 years old, we also suspected that it was due to the smaller sample sizes (25-27, n=117. 37-39, n=65) (Figure 4). When the sample sizes are large enough, the two peaks above may be disappeared. This result suggests that the paternal age between 31-33 years old is most conducive to the formation of high-quality embryos.

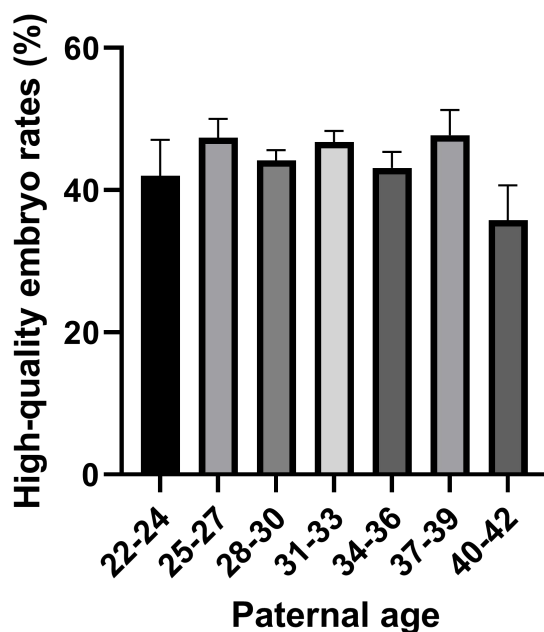


Figure 4 Effect of Paternal Age on the Formation of High-Quality Embryos

The influence of paternal sperms from different age group on the formation of high-quality embryos was statistically analyzed when the mothers were between 31-35 years old. (22-24, n=26. 25-27, n=117. 28-30, n=364. 31-33, n=390. 34-36, n=192. 37-39, n=65. 40-42, n=31)

2.5 Effect of Paternal Age on Blastocyst Formation

When paternal ages were older than 36 years old, the rates of blastocyst formation gradually decreased with the increase of age (Figure 5). But the rates of blastocyst formation were not affected when paternal ages young than 34 years old (Figure 5). The trough in 28-30 years old group was also suspected to be due to the insufficient sample size (n=364) (Figure 5). The result indicates that the paternal age less than 36 years old is conducive to blastocyst formation.

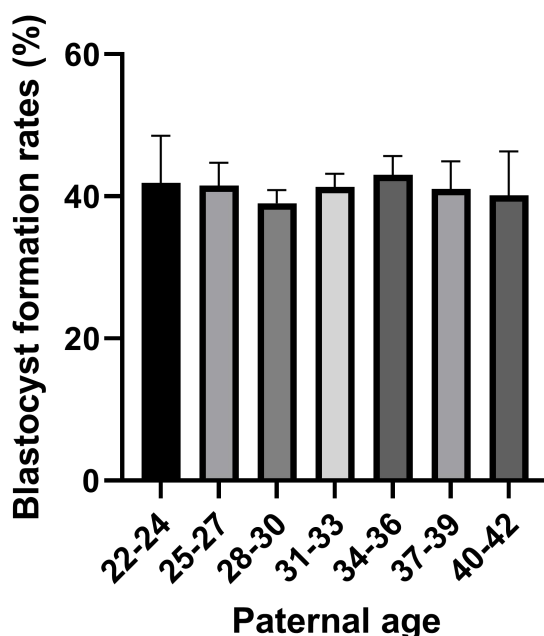


Figure 5 Effect of Paternal Age on Blastocyst Formation

The influence of paternal sperms from different age group on blastocyst formation was statistically analyzed when the mothers were between 31-35 years old. (22-24, n=26. 25-27, n=117. 28-30, n=364. 31-33, n=390. 34-36, n=192. 37-39, n=65. 40-42, n=31)

3 DISCUSSION

In this study, we investigated the influence of paternal age on the outcome of embryonic development. Eligible women aged 31-35 years old with infertility were selected from author's reproductive medicine center, which is also the peak age of infertile women in modern society. Exploring the effect of their husbands' age on embryo development can better reflect the influence of male reproductive age on embryo development and the overall fertility in modern society.

In this study, we found that although maternal age shows very important impact on the outcome of embryonic development, paternal age also plays a role. By comparing the data of normal fertilization rates, normal cleavage rates, effective embryo rates, good embryo rates and blastocyst formation rates, we found that the best age of male reproduction may be between 28-36 years old. This result will be helpful to guide the public how to choose the best male childbearing age, so that the majority of men can reasonably arrange their own birth plan.

The shortcomings of this study including that the data volume is not large enough, and it does not extend the age of paternal to whole age group also due to the limitation of data volume. If conditions permit, the author will continue to expand the sample size and the age range of paternal in order to obtain more realistic and useful results.

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

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