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Review

Routes to parenthood for women with Turner syndrome

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Key content

- Turner syndrome (TS) is the most common form of sex chromosome aneuploidy in women.
- Most women with TS have primary amenorrhoea, although some women with mosaic TS may have spontaneous menarche but have a significantly reduced ovarian reserve.
- Women with TS face higher obstetric and neonatal risks in pregnancy, and pregnancy may be contraindicated for some.
- Natural conception can occur in up to 8% of women with TS. For those with TS, assisted reproductive techniques using the woman's own eggs is possible for those with ovarian activity. For women with premature ovarian insufficiency, the use of donor gametes/embryos is possible, or surrogacy is an option for those with an underdeveloped uterus.
- Fertility preservation is possible for affected women with good ovarian reserve and offers an opportunity to achieve pregnancy when they are physically and psychologically ready.

Learning objectives

- To understand the underlying pathophysiology of the impact of TS on reproductive life.
- To be aware of the specific risks women with TS face during pregnancy.
- To be able to counsel women with TS regarding their available options for parenthood.

Ethical issues

- Does refusing fertility treatment to women with TS who have contraindications to pregnancy violate patient autonomy, or is it unethical to proceed with fertility treatment because it risks maternal death?
- Can girls with TS who have not yet reached the legal age of consent undergo oocyte freezing (if post-pubertal) or ovarian tissue freezing (if pre-pubertal)?

Keywords: fertility treatment / parenthood / pregnancy / Turner syndrome

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Introduction

Turner syndrome (TS) is the most common form of sex chromosome aneuploidy in women and, after Klinefelter syndrome, is the second most common overall genetic condition causing subfertility. The incidence of TS is approximately 1:2500 to 1:3000 live births, because a high proportion (close to 99%) of pregnancies with TS miscarry.[1,2] TS is noted in approximately one in ten first trimester miscarriages, and unlike Down syndrome, it is unrelated to maternal age.[3]

The karyotype of TS is classically a monosomy X with a full complement of autosomes, represented as 45 XO. There can also be a mosaic karyotype (46 XX, 45 XO) with some cells showing a normal female karyotype (46 XX) and others showing 45 XO. Rarer karyotype variants include isochromosome of the short or long arm of the X chromosome (46 X,iXq and 46 X,iXp) and other mosaic karyotypes (47 XXX, 45 XO and 46 XY, 45 XO).[1] The degree of mosaicism has a major influence on phenotypic expression, and the peripheral blood karyotype may be different from the karyotype from other tissues such as buccal or ovarian tissue. Hence, karyotyping of other tissues can be useful when there is a strong suspicion of TS on clinical grounds, in spite of a normal peripheral blood karyotype.

Clinical features

TS affects multiple organ systems, as shown in Figure 1. In a normal euploid female cell line (46 XX), one of the X chromosomes is inactivated by a process called lyonisation, which explains why TS is the only monosomy

compatible with live birth. However, some of the genes, such as *SHOX* (which mediates stature), escape lyonisation, thus accounting for the phenotypic features of TS.

Management of women with TS requires the involvement of a multidisciplinary team. An example of a screening protocol used at the authors' unit is shown in Table 1. In this article, the effects of TS on reproductive function are described and various options for parenthood are discussed.

Ovary

Women with TS frequently present with primary amenorrhoea. Those who do have spontaneous menarche, particularly women with mosaic TS, often have a significantly reduced ovarian reserve compared with their peers and have premature ovarian insufficiency and premature menopause. The mechanism behind this appears to be an accelerated atresia of primordial follicles in the ovary leading, in most cases, to exhaustion of the primordial follicle pool before the natural age of menarche.[4] This is thought to be mediated through meiotic chromosome pairing, as well as the effect of some genes on the X chromosome, such as *BMP15*, which are required in double dosage to prevent follicular apoptosis.[5,6] In women with mosaic TS, the pace of follicular atresia appears to be influenced by the proportion of cells that are karyotypically normal. However, these theories do not explain the occurrence of spontaneous menarche in some women with a karyotype suggestive of complete monosomy X. Recent evidence suggests that women with TS with spontaneous menarche have low levels of mosaicism not detected by routine karyotyping.[7] When tested in girls and adolescents with TS, serum anti-müllerian hormone (AMH) level, which is a marker for ovarian reserve, has been correlated with both karyotype and pubertal development.[8]

Uterus

Uterine growth and endometrial development depend on the underlying ovarian function. In women with TS who have spontaneous menarche, uterine growth is likely to be normal. On the other hand, women with TS who have primary amenorrhea are more likely to retain infantile dimensions of the uterus, and in these situations, it is important that the induction of puberty with exogenous estrogens as hormone replacement therapy (HRT) is tailored to closely mimic physiology. Before initiating HRT, it is useful to measure serum gonadotrophin levels to exclude delayed onset of puberty, because starting estrogen prematurely can compromise the final bone height achieved, considering that

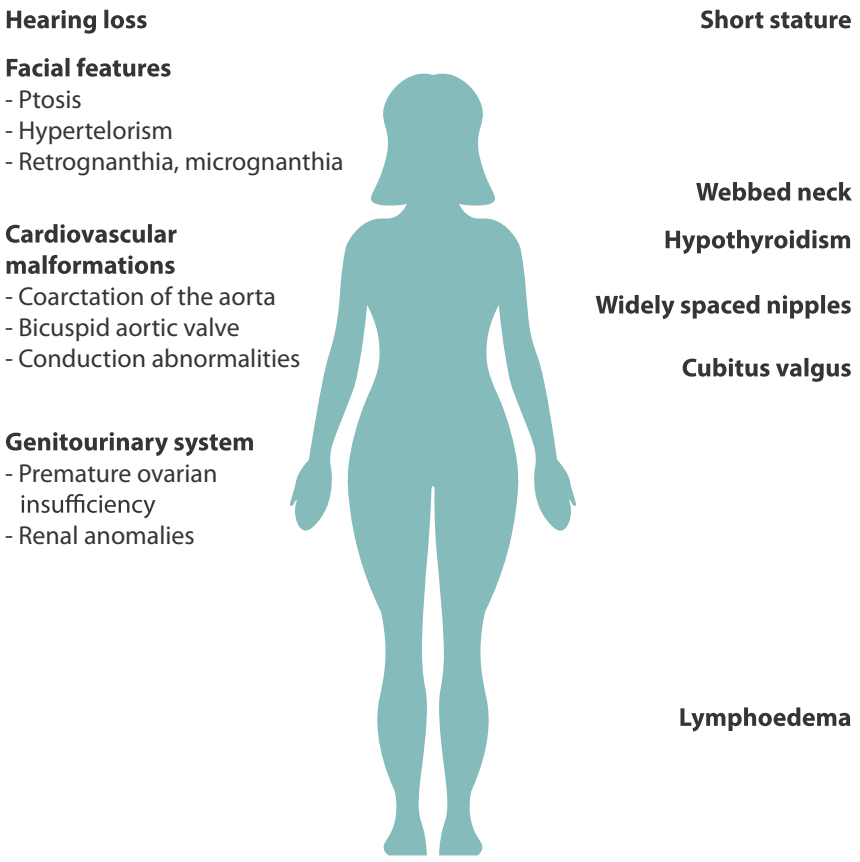

Figure 1. Features of Turner syndrome.

Table 1. Screening protocol for women with Turner syndrome

Screening test	Rationale for test
Anthropometry – height, weight, body mass index	Increased incidence of obesity
Blood pressure (both arms)	Risk of hypertension (coarctation of aorta) Target systolic BP <140 mmHg if aortic valve is tricuspid and <120 mmHg if aortic valve is bicuspid
Annual cardiac magnetic resonance imaging	Aortic root, coarctation of aorta, cardiac valve and left-sided cardiac anomalies
Renal and pelvic ultrasound	Renal anomalies, uterus, ovaries for antral follicle count (if having spontaneous menstrual cycles)
Coeliac antibody screen every 5 years	Increased incidence of coeliac disease
Audiogram every 3–5 years	Conductive hearing loss in childhood and progressive sensorineural hearing loss in adults
Diabetes screening, thyroid function test, lipid profile, renal and liver function tests annually	High incidence of impaired glucose tolerance and metabolic syndrome Increased incidence of altered liver enzymes and abnormal renal function
Dual-energy x-ray absorptiometry (DEXA) annually and, if stable, every 3–5 years	Bone density assessment

short stature is a manifestation of TS. In a Scientific Impact Paper published by the Royal College of Obstetricians and Gynaecologists (RCOG) on pubertal induction using sex steroids, the initiation of HRT for pubertal induction is discussed in detail. An example in this paper suggests starting a very low dose of estrogen (2 micrograms of ethinyl estradiol at 8 years of age) and gradually increasing the dose. It is advised that progestogen is added in after a suitable duration of unopposed estrogen or if breakthrough bleeding occurs.[9] HRT is also important for maintaining bone mineral density and in this respect, women with TS who had spontaneous menarche followed by premature ovarian insufficiency should be advised to take HRT until the natural age of menopause.[10]

Cardiovascular features of Turner syndrome

Women with TS are at risk of aortic dilatation and dissection. Given the general short stature of people with TS, aortic size should be assessed by indexing to body surface area. When assessed by magnetic resonance imaging (MRI), around one-third of patients with TS have an ascending aortic dimension greater than 20 mm/m^2, the 95th percentile for normal controls.[11] In a study of 166 patients with TS, there were three aortic dissections over 3 years and in all cases the ascending aorta measured more than 25 mm/m^2.[11]

Up to 30% of women with TS have a bicuspid aortic valve, around 12% have coarctation of the aorta,[12,13] and both of these conditions are associated with aortic dilatation. Hypertension is reported in up to half of adult women with TS.[14]

Pregnancy in women with Turner syndrome: risks and contraindications

Studies indicate that women with TS have a higher risk of adverse obstetric outcomes (e.g. miscarriage, hypothyroidism, gestational diabetes, hypertensive disorders of pregnancy) and neonatal outcomes (e.g. preterm birth, low birth weight and small for gestational age). The most dramatic risk, which can be sudden and life-threatening, is the risk of aortic dissection.[15]

Risk of aortic dissection in pregnancy

Pregnancy is an established risk factor for aortic dissection in women with aortopathy, whatever the aetiology, with the greatest risk in the third trimester and the early postpartum period.[16] The risk of aortic dissection appears to be very low in spontaneous TS pregnancy (a single reported case), with the majority of cases being reported in those who have undergone oocyte donation. The absolute risk of aortic dissection in pregnancy in women with TS is about 1%.[17,18] Pre-existing aortic dilatation, bicuspid aortic valve, coarctation and hypertension are risk factors. Dissection has been reported in women with TS who are not known to have any of these risk factors, although the quality of assessment was noted to be limited.[19]

Specific recommendations on management before and during pregnancy in women with TS were published in 2010 by a collaboration of French societies. Pregnancy is contraindicated when the aorta has an absolute diameter of greater than 35 mm or 25 mm/m^2, there is a history of aortic surgery or there is uncontrolled hypertension despite treatment. The presence of a bicuspid valve or coarctation were considered risk factors but not contraindications. The American Society for Reproductive Medicine considers the presence of any cardiovascular abnormality (e.g. aortic dilatation, aortic valve abnormality or coarctation) an absolute contraindication to pregnancy.[20]

Routes to parenthood for women with Turner syndrome

Prepregnancy counselling

The authors' practice is to perform a cardiac/aortic MRI scan in all women with TS considering pregnancy. When the

findings of this scan are normal, an aortic MRI is repeated every 5 years. If there is any abnormality, women are referred for long-term follow-up in the adult congenital heart disease clinic. Patients should be made aware of the potential risks and implications of cardiovascular abnormalities at or before the point of transition to adult services (from around 14–18 years of age), including the possibility that pregnancy is contraindicated in some cases. In view of the high risk of adverse maternal pregnancy outcome, women with TS should be referred for prepregnancy counselling to a joint obstetric–cardiology multidisciplinary clinic, or alternatively to a cardiologist with a special interest in congenital heart diseases and an obstetrician specialised in maternal medicine for pre-conception advice and work-up. This should ideally include an aortic MRI performed within the year prior to conception or planned fertility treatment.

Natural conception

Although the majority of girls with TS do not enter menarche spontaneously, it is possible that very few women with TS and some women with mosaic TS continue to have ovarian activity and therefore have a chance of natural conception. Recent studies suggest up to 8% of women with TS conceive naturally and have live births.[17,21–23] However, there appears to be an increased risk of miscarriage (31–45%) after natural conceptions for women with TS. This increased incidence of miscarriage is mainly attributed to reduced oocyte quality. However, the higher rates of miscarriage observed in women with TS who use oocyte donation suggest that suboptimal uterine development might play an additional role.[24] In the above studies, caesarean section rates are quoted to be between 46% and 63%. Short stature and haemodynamic changes during pregnancy/labour affecting the cardiovascular system are the likely reasons for an increased caesarean section rate in pregnant women with TS.

Inheritance risk of Turner syndrome

Women who have TS and a monosomy X karyotype (45 XO and mosaic 46 XX, 45 XO) can be reassured that they are not at risk of passing TS on to their children. However, women with TS who have deletions of the X chromosome or a ring X chromosome as their karyotype are at risk of passing on the abnormal X chromosome to their daughters; case reports confirm this.[25–27] Therefore, for those women in whom karyotyping reveals an abnormal X chromosome, it is valuable to offer a referral for genetic counselling.

Assisted reproductive techniques

A detailed discussion of assisted reproductive techniques (ART) is beyond the scope of this article. However, ART such as in vitro fertilisation (IVF) or intracytoplasmic sperm injection (ICSI) are recommended for women with TS who have ovarian activity but present with fertility problems. IVF/ICSI involves ovarian stimulation using gonadotrophins (dosage and duration of gonadotrophins depends on the ovarian reserve), with or following pituitary suppression, followed by an oocyte retrieval procedure under sedation, ensuring adequate ovarian response as monitored by ultrasound scan. The oocytes are then fertilised with the partner's sperm in the laboratory, and the resultant embryos are cultured with a view to selecting the best embryo(s) for transfer. ART is associated with a higher risk of obstetric and perinatal complications, but the association is multifactorial, with subfertility itself being a risk factor as well as the use of ART.[28]

Mature oocytes or embryos can be cryopreserved for future use in fertility treatment when the woman/couple feels ready to do so. Oocyte cryopreservation is no longer considered experimental.[29] However, as many of these women have reduced ovarian reserve by the time they are referred to fertility services, ovarian stimulation with gonadotrophins is associated with a high risk of suboptimal ovarian response to stimulation, resulting in a reduced number of available oocytes. Multiple cycles of ovarian stimulation may therefore be required to freeze a sufficient number of oocytes; current evidence suggests a clinical pregnancy rate of 5% per mature oocyte stored.[30] Embryo freezing is an option to women with TS with ovarian activity who have a stable partner, but are not ready to start a family. Embryo freezing can also be offered to single women with TS using donor sperm after counselling about the implications. Emerging data suggest similar pregnancy rates and better perinatal outcomes and health of children born through the use of frozen embryos compared to fresh IVF/ICSI treatment.[31,32]

The Human Fertilisation and Embryology Authority (HFEA) regulates fertility treatment in the UK. All fertility clinics in the UK are audited and supervised by the HFEA to ensure they meet the required regulatory standards.

Use of donor oocytes or embryos

Use of donor oocytes or embryo(s) enables women with TS and premature ovarian insufficiency to carry a pregnancy. Donors in the UK are either i) completely unrelated to the recipients and do it for 'altruistic reasons'; or ii) 'designated donors', i.e. a friend or relative who is willing to help the recipient. Embryo donation is legally straightforward for couples (whether heterosexual or same-sex couples) and the partner of the woman with TS will be the legal father/second parent. However, in women with TS who wish to achieve pregnancy as a single parent, there is a risk that the second legal parent of the child born out of donor embryo treatment could be the person whose sperm has been used to create embryo(s). Therefore, the HFEA advises couples donating embryos to seek legal advice. However, use of donor sperm and donor eggs may circumvent this issue.

Recent studies suggest a good pregnancy rate (27.5%) with the use of donor oocytes in women with TS.[22,23,33–35] Miscarriage rates appear to be similar to that of the general population (25%), but with an increased risk of hypertension-related complications (15–17%), aortic dissection (1–2%) and caesarean section rates (80–100%). The incidence of preterm birth (birth at fewer than 37 weeks of gestation) has been reported to be higher (12–38%) and there is a higher risk of babies being small for gestational age (weighing less than 2500 g; 18–57%). There is evidence to suggest donor oocyte pregnancy acts as an independent risk factor for pregnancy complications[36] and the use of donor oocytes in women with TS further increases this risk. These pregnancies should be closely monitored by a multidisciplinary team. Women with TS undergoing oocyte donation should be adequately counselled that they face higher risks during pregnancy than women with other causes of premature ovarian insufficiency undergoing oocyte donation. It is therefore recommended that women with TS have consultant-led antenatal care with multidisciplinary input.

Mother-to-daughter oocyte donation

In one case report, a 33-year-old mother froze her oocytes with a view to donating them to her daughter, who was diagnosed with Turner syndrome and was aged 6 years at the time of cryopreservation. Thirty oocytes were cryopreserved after three cycles of ovarian stimulation. This case report simultaneously raises new questions about preserving the genetic link for women with TS and presents new ethical dilemmas and challenges.[37]

Management in pregnancy

Pregnancy in women with TS should ideally be managed by a multidisciplinary team that includes obstetricians, cardiologists and anaesthetists. French guidance recommends assessment at the end of the first and second trimesters and monthly in the third trimester. Echocardiography should be performed at each visit and MRI scanning can be considered if the echocardiogram finds an increased aortic size or if it is insufficient to fully assess the aorta. The authors would consider a regular beta blocker, especially if any risk factors for dissection are present. Hypertension should be effectively treated. If the aortic valve has abnormal function, management should be similar to that of other pregnant women with aortic stenosis or regurgitation.

Mode and timing of delivery depend on individual assessment of risk. Caesarean section is very common in women with TS for obstetric reasons, but if obstetrically suitable, a vaginal delivery is possible. Epidural anaesthesia reduces cardiovascular stress and swings in blood pressure. Passive descent of the head to the perineum and instrumental delivery may be appropriate. Delivery should generally be planned to occur in a centre where acute cardiac surgery is available. If risk factors for dissection are present, it is the authors' usual practice to keep patients in hospital for 5 days after delivery in case urgent surgery is required.

Surrogacy

For women with TS who have any of the above-listed contraindications for a pregnancy, or when there appear to be issues with uterine development or endometrial receptivity, surrogacy provides an option of having a child or children. There are two types of surrogacy:

1. Gestational surrogacy, in which the surrogate does not use her own eggs and is genetically unrelated to the baby. This is an option for women with TS:
   a. for whom ovarian activity and oocyte retrieval procedure is practically possible;
   b. who have previously cryopreserved oocytes or embryos;
   c. with premature ovarian insufficiency using donor eggs or embryos.
2. Straight surrogacy, in which the surrogate also acts as the oocyte provider, allows for less invasive techniques such as artificial insemination using the sperm of the partner of the woman with TS. In this situation, the woman with TS will not be the genetic or biological mother but can become the legal mother once a parental order has been obtained. The partner of the woman with TS who provides the sperm will be the genetic and legal parent.

Fertility preservation

Since a diagnosis of TS is often made before adulthood, not all girls/young women would be ready to start a family at the time of diagnosis. In addition, the ovarian reserve at the time of diagnosis would generally be low, and further depletion of this reserve would occur at an accelerated rate. A majority of young women may still not reach adulthood with sufficient ovarian reserve. Timely consideration of fertility preservation for women with TS with ovarian activity may lead to fulfilment of the desire of becoming a genetic parent.

Mature oocyte freezing

In women who have mosaic TS, varying degrees of ovarian function can be retained for varying time intervals, although – as discussed above – premature ovarian insufficiency is unfortunately inevitable. Mature oocyte freezing after a cycle of ovarian stimulation and oocyte retrieval can be undertaken in postpubertal girls with TS provided they have a good ovarian reserve at the time of diagnosis and repeated if the ovarian response to controlled ovarian stimulation is good to optimize the number of oocytes retrieved. There are reports of successful oocyte cryopreservation (primarily in mosaic TS) as adults and as postpubertal adolescents.[38,39]

Oocyte cryopreservation is no longer experimental;[29] it is now an established procedure in adults. It is increasingly being offered to women prior to gonadotoxic therapy for the management of both cancerous and non-cancerous conditions and in women before undergoing gender reassignment treatment. However, many women with TS have reduced ovarian reserve by the time they are referred to fertility services. In these women, ovarian stimulation with gonadotrophins is associated with a high risk of suboptimal ovarian response to stimulation, resulting in a reduced number of oocytes available, which affects their pregnancy rates. Multiple cycles of ovarian stimulation may therefore be required to freeze a sufficient number of oocytes; current evidence suggests a clinical pregnancy rate of 5% per frozen–thawed mature oocyte.[39] These women must be counselled to have realistic expectations of a successful pregnancy.

Embryo freezing

Embryo freezing is an option to women with TS who have ovarian activity and a stable partner, but who are not ready to start a family for various reasons. Embryo freezing can also be offered to single women with TS using donor sperm after counselling about the implications.

There is some evidence to suggest similar pregnancy rates and better perinatal outcomes and health of children born through the use of frozen embryos compared to the use of fresh IVF/ICSI treatment in the general infertile population.[31,32] However, there is no good evidence on pregnancy outcomes for women with TS who undergo oocyte or embryo freezing.

Oocyte versus embryo freezing

Table 2 provides information on the suitable fertility preservation techniques for women with TS, taking into consideration pubertal status, ovarian activity and their individual circumstances. Mature oocyte freezing provides reproductive autonomy to women with TS. Frozen embryos may have to be discarded if there is a change in relationship status and the male partner does not consent to the use of stored embryos. Women with TS who consider freezing mature oocytes are likely to be younger, hence less likely to have had a stable relationship.

The first successful oocyte cryopreservation in a 28-year-old woman with mosaic TS was reported in 2008.[38] Since subsequent literature includes case reports or small cohort studies of postpubertal girls and women with TS undergoing oocyte cryopreservation before impending ovarian failure, there are insufficient data to assess whether the success rates of oocyte or embryo cryopreservation for women with TS are similar to those for women undergoing oocyte or embryo cryopreservation for other reasons.[39–41] Considering this lack of data, women with TS undergoing oocyte or embryo cryopreservation must be counselled to have realistic expectations of a successful pregnancy.

Table 2. Fertility preservation options for women with Turner syndrome

Aspects of fertility preservation covered by each technique	Oocyte freezing	Embryo freezing	Ovarian tissue freezing
Reproductive autonomy (no limitations on future relationship choices)	Yes	No (embryos may have to be discarded if relationship status changes)	Yes
Perinatal outcome and short-term health of children in women with/without TS	Limited data	Good data from women without TS	Very limited data
Need for assisted reproductive techniques (IVF/ICSI)	Yes	Yes	Optional (natural conception is possible after re-transplantation of frozen ovarian tissue)
Use of surrogacy if pregnancy contraindicated	Yes	Yes	May not be possible
Applicability	Postpubertal	Postpubertal (ideally for women in long-term, stable relationships)	Prepubertal and postpubertal

Key: TS = Turner syndrome; IVF = in vitro fertilisation; ICSI = intracytoplasmic sperm injection

The major limitation of freezing mature oocytes and embryos is that it can only be done for postpubertal girls with ovarian activity; hence freezing is not an option for the majority of girls and women with TS, who have primary amenorrhea with complete follicular atresia even before they reach puberty.

In addition, it is important to ensure that informed consent is obtained after a detailed discussion of the process of ovarian stimulation and oocyte retrieval, especially in adolescent girls with TS, to ensure they have a full understanding of the risks involved. The youngest postpubertal girl undergoing oocyte cryopreservation in the known literature was aged 13 years at the time of the procedure. Adequate measures must be taken to ensure that informed consent is obtained.[40]

Ovarian tissue freezing

Freezing of the ovarian cortex is an option for fertility preservation, particularly in prepubertal girls with TS who

have some ovarian activity and for whom oocyte freezing cannot be done. Predictive factors for the presence of ovarian follicles include signs of spontaneous puberty, mosaicism and normal follicle stimulating hormone (FSH) and AMH levels.[42] Freezing of the ovarian cortex and re-transplantation into the pelvis (autologous transplantation) has resulted in live births in women without TS. However, the technique is still considered experimental, and there is a lack of long-term safety data. An alternative to freezing the ovarian cortex is to freeze the entire ovary; aspiration of immature oocytes from follicles on the ovary and maturing them in vitro to mature oocytes that can then be frozen has also been described. However, no pregnancies have been reported following whole ovary freezing or after in vitro maturation of follicles retrieved from frozen ovarian tissue.

Adoption and fostering

When fertility treatments are not acceptable or not advisable for women with TS, alternative parenting options such as adoption and fostering could be realistic and acceptable options to help them with their goal to complete their family unit.

Choosing to be child-free

Women with TS may opt to remain child-free, a choice which may be influenced by the significant health issues outlined above, considering the strain on health caused by invasive fertility treatment and pregnancy. This decision is also influenced by financial constraints caused by the unequal availability of public funding for various fertility treatment options.

Ethical dilemmas

Refusing fertility treatment to women with TS who have any of the above-listed contraindications could be argued as representing paternalism and violating patient autonomy. On the other hand, proceeding to fertility treatment would place the medical practitioner in an unethical position because it might endanger life.

As aortic dilatation and hypertension can worsen over time, there is a risk that women with TS who have frozen their oocytes or embryos may be unable to use them in the future when pregnancy is contraindicated. Hence, they must be counselled about the possibility of needing surrogacy in this scenario.

There are also ethical issues surrounding whether postpubertal girls with TS who have not yet attained the legal age for consent can choose to have their oocytes frozen. It is important to consider whether they have fully understood all of the issues involved.

Ovarian tissue freezing can be offered to girls who are too young to have their oocytes frozen. This raises additional ethical concerns, considering that this technique remains experimental.

The HFEA mandates that fertility units should perform a 'welfare of the child' assessment to assess any significant risks of harm or neglect to a child born from fertility treatment and whether there is adequate parenting support available for the child. Women with TS who opt for surrogacy because of medical contraindications may have a reduced life expectancy and there must be a careful assessment as to whether the welfare of the child who is born as a result of fertility treatment is compromised.

Relationship issues influencing parenthood for women with Turner syndrome

A 6-year follow-up survey noted that women with TS had lower self-esteem than controls and more of them lived alone. They had fewer sexual partners and less sexual confidence, which might influence their relationship and reproductive choices.[43] A pilot interventional study for women with TS using a 1-day psychological workshop suggested that such low-cost interventions might help improve self-esteem for women with TS.[44]

Conclusion

Women with TS face unique health risks during pregnancy and this, coupled with the ovarian and uterine effects of TS, means that the reproductive choices they face are unique among the subset of women undergoing fertility treatment. It is therefore vital that they have access to tailored information and the support of medical staff and counsellors to help them make informed decisions with regard to their reproductive choices. Access to support groups such as the Turner Syndrome Support Group is also helpful for women with TS to find peer support, which includes, but is not limited to, their reproductive health wishes and choices. This review aims to be a useful resource for healthcare professionals involved in the care of women with TS to support and counsel them about the fertility and treatment options available to them.

Disclosure of interests

There are no conflicts of interest.

Contribution to authorship

HMB conceived the topic and both MM and HMB planned the scope of the article. MM researched and wrote the initial draft. JO and HMB reviewed and revised the manuscript. All authors approved the final version.

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