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Surgery for Male Infertility

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Abstract

In the past decade, there have been significant changes in the available treatment options for infertile men. Novel medical and minimally invasive treatments have been introduced. However, the management of male infertility will often involve surgical therapy, particularly with regard to azoospermia. For azoospermic men, surgical sperm retrieval is essential to allow subsequent treatment with assisted reproduction. Furthermore, a surgical approach allows diagnostic information to be gathered regarding the cause and prognosis for treatment success. Surgical treatment of male infertility can be very successful at providing high rates of pregnancy and is typically more cost effective than alternative forms of treatment such as assisted reproduction procedures alone.

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1. Introduction

Male reproductive health has become an important issue in current assisted reproduction. During recent years the perception of the ''male factor'' contributing to infertility has undergone a number of revisions, realizing that >50% of infertility is entirely or in part due to a male factor [1]. Outcomes of assisted reproduction are primarily dependent on the availability of viable sperm and age of the female member of the couple being treated. In azoospermic men intracytoplasmic sperm injection (ICSI) has become the standard therapy [2–4]. Nevertheless, the treatment of obstructive and nonobstructive azoospermia (NOA) will often include a surgical intervention. For men with NOA, surgical sperm retrieval is required to allow successful treatment with ICSI. For men with obstructive azoospermia sperm retrieval rates approach 100% and microsurgical vasectomy reversal provides a very high chance of resulting in delivery of a child. Additionally, surgical treatment is more cost effective than alternative forms of treatment such as assisted reproduction procedures alone [5,6]. The aim of this article is to provide updated information regarding surgical treatment options for male infertility and to present current literature and data.

2. Testis biopsy

A testis biopsy is a diagnostic technique to assess spermatogenesis. It is most useful to determine whether obstruction is the cause of azoospermia. In men with NOA testis biopsy can provide some, but not absolute, diagnostic information. It can also rule

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out the unlikely possibility of testicular intratubular germ cell neoplasia (carcinoma in situ) that is more common in men with unexplained unilateral testicular atrophy or with a history of cryptorchidism [7]. Infertile men with abnormal semen analyses have a 20-fold greater incidence of testicular cancer compared to the general population [8]. Furthermore, it is possible to take additional tissue during this diagnostic procedure that can be frozen for subsequent therapeutic trials of assisted reproduction. Cytologic evaluation, when performed concurrently with standard testicular biopsy, may provide important adjunctive information. Cytospin and touch prep techniques allow for the detection of late maturation arrest, which is not evaluable on fixed permanent sections. Additionally, cytospin and touch prep techniques allow the evaluation of the presence of sperm within the seminiferous tubule without the removal of an additional piece of testicular parenchyma. The wet prep technique allows the evaluation of sperm motility. The presence of sperm motility appears to be highly indicative of the presence of obstruction. Further information regarding the frequency of late maturation arrest and the endurance of the predictive value of wet prep sperm motility is needed. At present, cytologic techniques should best be considered adjuncts to, but not replacements of, careful evaluation of fixed permanent testicular biopsy specimens [9].

Adequate specimens for tissue evaluation can be obtained by open biopsy, needle biopsy, or, occasionally, fine-needle aspiration [10–12]. Given the potential inadequacy of needle biopsy or fine-needle aspiration, with the attendant risks to the vasculature of the testis, the open biopsy technique is preferable [13,14]. The biopsy should be performed prior to reconstruction (rather than simultaneous to vasoepididymostomy), so that a definitive analysis of sperm production is possible on fixed sections prior to further exploration. Diagnostic information on the status of spermatogenesis is most reliably determined on evaluation of a thin-sectioned, stained, fixed tissue specimen. In testicular biopsies the most advanced spermatogenic pattern, as opposed to the predominant pattern, appears to affect the results of sperm retrieval. For men who had at least one area of hypospermatogenesis present on diagnostic testis biopsy, spermatozoa were retrieved in 57 of 73 attempts (81%), whereas for men with maturation arrest as the most advanced pattern, spermatozoa were retrieved in only 27 of 62 attempts (44%). If the entire diagnostic biopsy had a Sertoli cell-only pattern, our most recent data found that sperm could be retrieved for 41% (98 of 257) of testicular sperm extraction (TESE) attempts [15]. Although no finding absolutely determined sperm retrieval or negated the possibility of successful TESE, the findings of diagnostic biopsy were helpful in evaluating the chance of success with testicular sperm extraction [16].

In the authors' experience a diagnostic testis biopsy is not required prior to TESE-ICSI for NOA. A diagnostic biopsy should be performed if the etiology of azoospermia is not clear, if the risk of carcinoma in situ is high (rare), or if the results of biopsy will affect the couple's choice to undergo TESE-ICSI [17].

3. Genetic abnormalities and testing

Genetic disorders are associated with spermatogenic failure. These abnormalities include chromosomal abnormalities, detectable with routine karyotype testing, Y chromosome microdeletions, so-called ''AZF defects'' and mutations in the cystic fibrosis transmembrane conductance regulator (CFTR) gene. It is apparent that assisted reproduction and in particular ICSI may skew the natural selection process and that a potential risk associated with its use is the transfer of genetic defects from one generation to the next. Therefore, karyotype evaluation and Y chromosome microdeletion analysis is recommended for men with severe male factor infertility, including sperm concentrations $<10 \times 10^6$/cc and NOA, before treatment with assisted reproduction [17].

3.1. *Karyotype evaluation*

The most common karyotypic abnormality in men with severe male factor infertility is Klinefelter's syndrome, affecting up to 7–13% of azoospermic men. Almost all men with the ''classic form'' (47,XXY) of Klinefelter's syndrome will be azoospermic, whereas limited sperm production is commonly found in men with a mosaic pattern of Klinefelter's syndrome. Other karyotypic abnormalities identified include Robertsonian translocations, chromosomal inversions, and sex chromosome abnormalities.

3.2. *Y chromosome (AZF) microdeletions*

Microdeletions on the long arm of the Y chromosome have been demonstrated to disrupt spermatogenesis in 5–15% of men with azoospermia or severe oligospermia. Y chromosome microdeletions affecting fertility usually involve deletion of one or more of the entire AZFa, AZFb, or AZFc regions. The