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Male Infertility

Recent Developments and Current Practice

Complimentary Online Access to Color Images

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CHAPTER 6

Sperm Retrieval Techniques

Sunil Jindal, Anshu Jindal

INTRODUCTION

Azoospermia, the absence of sperm in the semen, presents a formidable challenge in the realm of male infertility treatment. Historically, treatment options were limited, often involving reconstructive surgery or donor insemination. However, the landscape changed dramatically with the advent of assisted reproductive technologies (ART), particularly intracytoplasmic sperm injection (ICSI), which revolutionized the management of male infertility.[1]

EVOLUTION OF SPERM RETRIEVAL TECHNIQUES

The evolution of sperm retrieval techniques is a testament to the relentless pursuit of solutions for azoospermia. Early pioneers in the field laid the foundation for modern techniques, refining approaches to maximize sperm retrieval rates (SRRs) while minimizing procedural risks.

TECHNIQUES FOR SPERM RETRIEVAL FROM THE EPIDIDYMIS

Microsurgical Epididymal Sperm Aspiration

Procedure

Microsurgical epididymal sperm aspiration (MESA) involves meticulous microsurgical dissection of the epididymis using an operating microscope. The surgeon navigates through the epididymal tubules, aspirating sperm from various locations. This technique is particularly effective in cases of obstructive azoospermia.

Success Rates

Numerous studies have reported high success rates with MESA, especially when coupled with advanced ART techniques such as ICSI. Success often depends on the surgeon's skill and the patient's specific anatomy.

Case Study

A 35-year-old male diagnosed with obstructive azoospermia underwent MESA, resulting in the successful retrieval of motile sperm for subsequent ICSI. The couple achieved a successful pregnancy and delivered a healthy baby.

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Open Fine Needle Aspiration

Procedure

Open fine needle aspiration (OFNA) offers a less complex alternative to MESA, involving direct puncture of the epididymal ductule using a fine needle. This technique reduces surgical time and resource utilization while maintaining efficacy in sperm retrieval.

Comparative Studies

Comparative studies have shown comparable success rates between OFNA and MESA, highlighting OFNA's role as a viable option in selected cases of obstructive azoospermia.

Percutaneous Epididymal Sperm Aspiration

Procedure

Percutaneous epididymal sperm aspiration (PESA) is a minimally invasive technique performed under local anesthesia. A needle is inserted through the scrotal skin into the epididymis and spermatic fluid is aspirated **(Figs. 1 and 2)**. PESA is often preferred for its simplicity and lower invasiveness compared to microsurgical approaches.

Advantages and Considerations

Percutaneous epididymal sperm aspiration is associated with shorter recovery times and reduced surgical complexity. However, it may have lower SRRs compared to microsurgical techniques in certain cases.



Fig. 1: PESA procedure. *(For color version, see Plate 1)*.

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Fig. 2: PESA sample. *(For color version, see Plate 2).*



Fig. 3: Testicular sperm aspiration. *(For color version, see Plate 2).*

TECHNIQUES FOR SPERM RETRIEVAL FROM THE TESTES

Nonmicrosurgical Approaches

- *Testicular sperm aspiration (TESA)/testicular fine needle aspiration biopsy (FNAB):* Involves using a 20- or 22-G scalp vein needle to aspirate fluid and tiny pieces of testicular tissue for sperm inspection **(Fig. 3)**.
- *Needle aspiration biopsy (NAB)/needle testicular sperm extraction (nTESE):* Utilizes an 18-G scalp vein needle to obtain a core of seminiferous tubules for sperm retrieval. This method is less traumatic than

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TESA as it aims to acquire a proper piece of testicular tissue without extensive tissue maceration.

Success Rates and Challenges

While TESA/FNAB can yield viable sperm, success rates may vary depending on testicular histology and spermatogenic capacity. Patients with severe testicular damage or impaired spermatogenesis may have lower success rates.

Emerging Research

Recent studies explore the use of advanced imaging techniques, such as multiparametric ultrasound to improve the accuracy of testicular sperm retrieval and enhance success rates.

Microsurgical Techniques

Procedure

Microsurgical TESE (Micro-TESE) is a sophisticated microsurgical procedure performed under high magnification using an operating microscope. The surgeon meticulously dissects testicular tissue, identifying areas with potential sperm production **(Figs. 4 and 5)**. This targeted approach minimizes tissue damage and maximizes SRRs.

Indications and Success Rates

Micro-TESE is often recommended for men with nonobstructive azoospermia or those with previous failed sperm retrieval attempts. Studies have shown

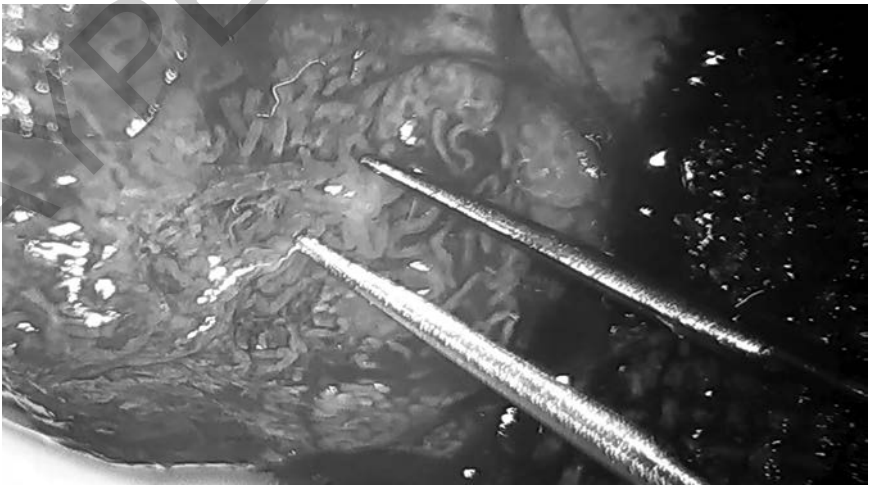

Fig. 4: Micro-TESE in maturation arrest. *(For color version, see Plate 3)*.

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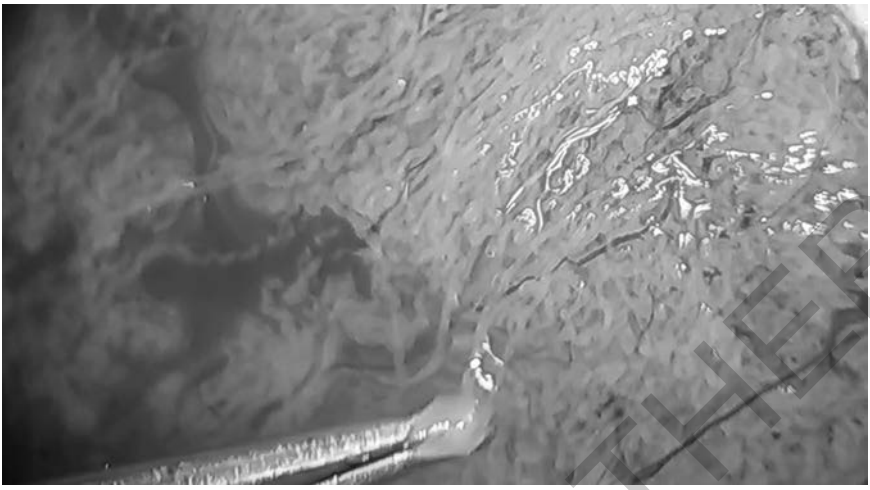

Fig. 5: Micro-TESE in Sertoli only syndrome. *(For color version, see Plate 3)*.

significantly higher SRRs with micro-TESE compared to conventional open biopsy techniques.

Case Study

A 30-year-old male with Klinefelter syndrome and nonobstructive azoospermia underwent micro-TESE, resulting in the successful retrieval of viable sperm for ICSI. The couple achieved pregnancy after multiple cycles of ART.

Studies have shown varying success rates in sperm retrieval based on the technique used:

- Micro-TESE has been reported to have the highest SRRs compared to conventional TESE (cTESE) and percutaneous techniques such as TESA.[2]
- Micro-TESE is particularly effective in men with specific conditions like Sertoli cell-only syndrome, although its superiority over cTESE is debated in cases of maturation arrest.
- Complications associated with operative sperm retrieval include infection, bleeding, hematoma, and testicular damage, with micro-TESE causing less physiological damage compared to multiple biopsies by cTESE.[3]

Hybrid Techniques (Single Seminiferous Tubule Mapping)

Procedure

Single seminiferous tubule (SST) mapping involves microsurgical inspection and biopsy of individual seminiferous tubules **(Figs. 6 and 7)**. This precise

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Fig. 6: Needle placement in SST. *(For color version, see Plate 4)*.



Fig. 7: Core tissue extraction in SST. *(For color version, see Plate 4)*.

approach allows for targeted sampling of testicular tissue, increasing the likelihood of sperm retrieval.

Advantages and Applications

Single seminiferous tubule mapping is particularly useful in cases where specific areas of spermatogenesis are preserved within the testes. It minimizes

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unnecessary tissue trauma and optimizes the use of retrieved sperm for ART procedures.

EFFICACY OF SPERM RETRIEVAL

The efficacy of sperm retrieval techniques depends on various factors, including the underlying cause of azoospermia, testicular histology, hormonal levels, genetic factors, and individual patient characteristics. While some techniques, such as micro-TESE, consistently yield high success rates, personalized approaches are essential to optimize outcomes for each patient.

COMPLICATIONS AND CONSIDERATIONS

Operative sperm retrieval procedures, including micro-TESE, carry potential risks such as infection, bleeding, hematoma formation, and testicular damage. However, advances in surgical techniques, anesthesia protocols, and postoperative care have significantly reduced the incidence of complications.

SPERM RETRIEVAL IN SPECIFIC CONDITIONS

- *Ejaculatory failure:* In cases of ejaculatory dysfunction, such as retrograde ejaculation or anejaculation, testicular sperm retrieval techniques such as NAB are preferred over epididymal techniques due to the absence of obstruction.
- *Necrozoospermia:* Despite immotile or dead sperm in ejaculated samples, viable sperm can often be retrieved from the testis using techniques such as NAB or micro-TESE. The ability to retrieve viable sperm offers hope for fertility restoration in these challenging cases.

OPTIMIZING SPERM RETRIEVAL STRATEGIES

Tailored approaches to sperm retrieval consider the unique characteristics of each patient, including the type of azoospermia (obstructive vs. nonobstructive), spermatogenic capacity, previous surgical interventions, hormonal levels, and genetic factors. Multidisciplinary collaboration between andrologists, urologists, reproductive endocrinologists, and embryologists is crucial in developing personalized treatment plans.

ADVANCES IN HORMONAL STIMULATION

Hormonal therapies, such as gonadotropin-releasing hormone (GnRH) agonists and human chorionic gonadotropin (hCG), play a role in optimizing spermatogenesis before sperm retrieval procedures. These hormonal

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Male Infertility

Recent Developments and Current Practice

In recent years, our understanding of the phenomenon of male infertility has evolved significantly, with advancements in research and clinical practice shedding light on various aspects of this complex condition.

Of the current concepts in male infertility, recognition of the importance of genetics and lifestyle factors is now evolving. The incorporation of genetic testing into the diagnostic workup of infertile men has become increasingly common, allowing for more targeted treatment approaches. Additionally, the impact of lifestyle factors on male fertility has gained more attention in recent years. Factors such as obesity, stress, and exposure to endocrine-disrupting chemicals have been shown to negatively affect sperm quality and quantity. Consequently, the importance of lifestyle modifications, including weight management, stress reduction, and avoidance of environmental toxins, has become a central focus in the management of male infertility.

In this publication, we focus on some of the most recent current evidence-based treatments in this field. We cover existing medications, newly introduced medical treatment alternatives and cutting-edge therapies including surgical management. The chapters have been authored by some of the foremost clinicians in the field and the readers will appreciate the focused content which will hopefully serve to improve their clinical practice.

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