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Original article

Cell therapy for urinary incontinence. Does it really work?

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Abstract: Stress urinary incontinence (SUI) is the most common form of urinary incontinence, a condition that affects approximately two hundred million people worldwide, significantly reduces the quality of life and exacerbates co-morbidities. The causes of stress urinary incontinence are urethral hypermobility, intrinsic sphincter deficiency, or both. There are different ways of treatment of SUI, inter alia: a gold standard procedure - retropubic repair or urethral sling placement. In selected cases the injection of bulking agents or installation of an artificial sphincter are performed. These methods have advantages as well as disadvantages. That is why the new ways of treatment are sought. Newly emerging technologies in tissue engineering may provide novel methods for the treatment of SUI. The deficiencies of urethral muscle and connective tissue can be regenerate by stem-cell therapy, which is currently at the forefront of incontinence research. The stem-cell therapy is very important in a way of replacing, regenerating, or enhancing the biological function of damaged tissue or organs. The choice of stem cell source is determined by ease of harvest, population density and differentiation potential. Results of in vivo experiments as well as clinical application of injecting stem cells are promising but also have some limitations.

Key words: Stress Urinary Incontinence; Mesenchymal Stem Cells; Stem Cell Therapy.

INTRODUCTION

Stress urinary incontinence is the most common form of urinary incontinence, a condition that affects approximately two hundred million people worldwide.[1,2] SUI is characterized by an involuntary passing of urine, synchronous with exertion, sneezing or coughing. SUI also significantly reduces the quality of life and exacerbates co-morbidities.[3]

Generally, SUI affects approximately 20% of young women but increases to 50% in elderly women.[4,5] Moreover, the number of patients presenting with this urologic health problem will rise as the baby-boomer generation continues to age.[6]

The aetiology of SUI involves many factors, such as the functional impairment of pelvic muscles, connective tissue and their associated innervating nerves. These factors occur secondary to pelvic floor damage following vaginal childbirth, advancing age, and hormonal status.[7-10] The causes of stress urinary incontinence are urethral hypermobility, intrinsic sphincter deficiency (ISD), or both.11 ISD is characterized by a malfunction of the urethral muscle closure mechanism, whereas urethral hypermobility occurs following the loss of bladder neck support and a lack of intra-abdominal pressure transmitted to the proximal urethra. It seems reasonable that SUI varies between the extremes of intrinsic sphincter deficiency and urethral hypermobility, thus the majority of patients presenting with stress incontinence often present with elements of ISD and hypermobility.[11-13]

MATERIALS AND METHODS

What is a current treatment for SUI?

SUI can be treated with physicobehavioral therapy alone or combined with pharmacotherapy, whereas surgical intervention is considered based on SUI intensity and etiological criteria. Therefore SUI can be divided into moderate, mild and severe.[14] The treatment of mild SUI is based on pelvic and floor exercises, electric stimulation of the pelvic floor and pharmacotherapy whereas moderate and severe SUI needs urethral sling or retropubic repair. In selected cases the injection of bulking agents or installation of an artificial sphincter are performed. The therapeutic effect of injections and pharmacology are usually disappointing.[14]

The current treatment of SUI is suburethral sling placement, which is very popular and good working method. This procedure involves applying autologic, allogenic, xenogenic or various artificial materials to suspend the bladder neck or urethra. The graft options for sling therapy include: autografts (eg, rectus fascia, fascia lata, vaginal wall), allografts (cadaveric tissues, including dura mater, dermis, fascia lata), xenografts (porcine small intestinal submucosa, porcine dermis), and synthetic artificial materials (polytetrafluoroethylene, polypropylene, silicone elastomers, polyglactic acid, polyester). Selection of each graft material depends on its own inherent advantages and disadvantages because the ideal sling material should be readily available, durable and does not trigger immune response while performing its intended function.[6] There is also the possibility of using artificial urinary sphincters that offer reliable continence and are highly efficacious. However, the cost of the artificial urinary sphincter remains and after such implant operations, functional disorders and local tissue erosion have been observed.[15]

Bulking agents and SUI treatment

Injectable bulking agents have become popular in the treatment of stress urinary incontinence due to intrinsic sphincter deficiency (ISD). Urethral bulking agents offer a less-invasive support for the urethra than sling procedures or artificial sphincters. By adding bulk to the bladder neck and the proximal segment of the urethra, the increased coaptation of the urethral mucosa protects against the increases of intravesical pressure by improving the resistance to the outflow of urine.[16] Injectable bulking agents that are frequently used include Teflon, bovine collagen, silicone particles, carbon beads, and autologous ear chondrocytes. Although chondrocytes injection is a cell therapy, the target of this method is not a muscle tonus improvement. It works as a 'closing mechanism', which does not lead to muscle regeneration.

Bulking agents have been used successfully, however they are known to induce chronic inflammatory reactions leading to periurethral abscesses, erosion of the urinary bladder or the urethra, obstruction of the lower urinary tract with resultant urinary retention, severe voiding dysfunction, migration to inner organs, and pulmonary embolism.[17]

The above mentioned techniques are considered unsatisfactory because the "bulking" of the urogenital tract can cause obstruction of the urethra and a passive sealing of the urethral lumen, without restoring the sphincter function. Also the closure apparatus may become inflexible and rigid.[18]

Modern techniques of sphincter regeneration have come from "bulking agent therapies". Cells can be used as a "natural bulking agent" when transplanted into the space between bladder neck and urethra. Bulking agents need large volume of cell suspension, in which cell viability is low. Bulking agents only narrow the light of the urethra while stem cells are designed to regenerate the sphincter, a method derived from the original concept of injecting bulking agents.[19-20]

Different sources of stem cells in treatment of SUI

Newly emerging technologies in tissue engineering may provide novel methods for the treatment of SUI. The deficiencies of urethral muscle and connective tissue that results in ISD can be regenerate by stem-cell therapy, which is currently at the forefront of incontinence research.[21] The stem-cell therapy is very important in a way of replacing, regenerating, or enhancing the biological function of damaged tissue or organs. Stem cells injected into muscle area over the middle urethra can restore the contractility of rhabdosphincter. The type of stem cells, which can be potentially used in the treatment of stress urinary incontinence are adult stem cells.[22] Over the past few years, mesenchymal stem cells (MSC) have been derived from various types of tissues including bone marrow, umbilical cord blood, adipose tissue, skin, periosteum, and dental pulp.[23-28] Cell-based therapies are most often associated with the use of autologous multipotent stem cells. The choice of stem cell source is determined by ease of harvest, population density and differentiation potential.

The new autologous sources are: muscle-derived stem cells (MDSCs) and adipose-derived stem cells (ADSCs). Both are advantageous because cells can be easily obtained in large quantities under local anesthesia. MDSCs injection therapy, often referred to as myoblast transfer therapy, will not cause an immunogenic reaction, because it is an autologous cell transplantation.[29-31] Muscle-derived stem cells are also physiologically capable of improving urethral function, as it has been proposed that the newly formed myofibers and myotubes may receive excitable stimulus as part of the syncitium.[19, 20, 32]

Zuk and associates demonstrated that ADSCs can differentiate *in vitro* into adipogenic, myogenic, and osteogenic cells in the presence of lineage-specific induction factors.[25] In addition, Rodriguez and colleagues reported that smooth muscle cells derived from ADSCs exhibit the functional ability to contract and relax in response to pharmacologic agents.[33] Thus providing the experimental basis that supports the injection ADSCs to improve the function of impaired urethra sphincter muscle. Human adipose-derived stem cells may also represent an alternative stem cell source for the treatment of stress urinary incontinence.[34]

Above mentioned cell therapies using MDSCs and ADSCs offer a promising technology for the treat of stress urinary incontinence.

Bone marrow stem cells and muscle differentiation.

The bone marrow stroma is commonly described source of multipotent stem cells. Bone marrow contains several cell populations one of which is MSC compartment.[35] Autologous mesenchymal stem cells are capable of differentiating into adipogenic, chondrogenic, osteogenic, and myogenic cell lines.[35-38] Although there are some limitations of using MSCs, such as the painful process of harvesting autologous bone marrow (often requiring the use of general or spinal anesthesia) and the low numbers of growing cells (the necessity of differentiation and the inability to predict or track differentiation), the MSCs are very popular, evolutionarily youngest cells and commonly used in cell therapy.[39] Muscle cells have been generated in vitro from human bone marrow using 5-azacytidine, an analogue of cytidine which induces DNA hypomethylation.[40] 5-azacytidine was also shown to induce mouse 10T1/2 fibroblasts to differentiate into skeletal myoblasts by reactivation of the transcription of silenced genes including MyoD family.[41] Similar results have been achieved by co-culturing MSCs with muscle cells and exposure of the mesenchymal stem cells to low bovine or horse serum concentration.[42] However, most of the data regarding the differentiation of muscle cells from bone marrow come from *in vivo* experiments. Different studies demonstrated that damaged muscles may be repaired either after whole bone marrow transplantation or by direct injection of bone marrow cells into damaged muscles.[40,43,44] The myogenic repair can be promoted by the fusion to existing and/or damaged myocytes that paracrine release cytokines and factors.[42] Both *in vitro* and *in vivo* studies have indicated that several factors such as, microenvironment, cell-to-cell contact and extracellular matrix play a key role in determining the function and differentiation of mesenchymal stem cells.[40,42,43,44] Engler and colleagues showed that during ex vivo culture of MSCs, lineage differentiation could be directed by the elasticity of the matrix on which the cells are grown.[45] Moreover, authors demonstrated that mesenchymal stem cells differentiate into myogenic precursors when cultured on gels of varying elasticity.

Regardless of the success achieved with mesenchymal stem cells, the level of differentiation *in vitro* has raised a number of questions that remain unanswered. It is not known whether pre-differentiation of MSCs will be essential in clinical applications and whether undifferentiated stem cells differentiate into the host muscle cells *in vivo*.[43]

Results of *in vivo* experiments

Cannon and colleagues performed injection of muscle derived progenitor cells into denervated female rat urethras.[46] The injection of muscle derived progenitor cells into the denervated sphincter significantly improved fast-twitch muscle contraction amplitude. Two weeks following injection, immunohistochemistry revealed a large amount of new skeletal muscle fiber formation at the injection site of the urethra with minimal inflammation. The subsequent experiments showed that allogenic MDSCs significantly improved the LPP in nerve transected animals after one and four weeks. Authors observed coincidence between doses and improvement. [21,47] Likewise two, four and six weeks after the cauterization of periurethral tissue the mean LPP in rats that received MDSCs was markedly increased compared to the sham procedure group. MDSCs have been also seeded onto a urethral sling with positive effects. That means urethral slings could be an effective delivery mechanism for these cells.[48] MDSCs are able to multipotent differentiation in the host tissue or have the capacity to elict a paracrine effect resulting in a more complete regenerative muscle-nerve healing response, what was observed in a rat model of SUI.[46] Chermansky and colleagues showed that MDSCs had integrated four weeks after injection within the striated muscle layer of the cauterized middle urethra.[49] Additionally, the striated muscle layer of the MDSCs-injected urethra was contiguous and better innervated than the cauterized urethra injected with only saline solution. Furthermore, in the groups of rats injected with MDSCs the increase in leak point pressure (LPP) was noticed as significant when compared with the cauterized rats injected with saline solution. Importantly, the difference in LPP observed four and six weeks after the MDSCs injection was not significant when compared with the uncauterized control rats. Kwon and colleagues compared MDSCs and fibroblasts using LPP as a marker of improvement.[47] The comparison was made with

regard to their potential for restoration of urethral function after injection. The short-term experiment with equal cell dosage exhibited no significant difference between MDSCs and fibroblasts or their combination. When the dosage was varied by two 10-fold increases, only a high dose of injected fibroblasts led to urinary retention, while high doses of MDSCs did not result in such adverse events. That's mean the fibroblasts may produce a bulking effect and make the tissue less compliant.[47]

The potential use of ADSCs with biodegradable microbeads in a rat model of SUI has been suggested. Improvement in LPP and urethral function was reported.[50]

Results of clinical application of injecting stem cells

Carr and coworkers have conducted clinical studies with MDSCs biopsy from lateral thigh muscle.[51] Eight patients were included in the first trial using either a periurethral or transurethral MDSCs injections into the middle urethra and external urethral sphincter (EUS). The measurable improvement was observed in two patients who underwent periurethral injection and two patients who received transurethral injections with using a 10-mm needle. Two patients with initial injections using an 8-mm needle had no benefit. Five of eight patients followed up for more than one year reported significant improvement. That's why these results are the potential for pure cellular therapy in treating stress urinary incontinence and emphasize the importance of proper cell placement in resulting effectiveness.

The I phase of next clinical trial, in which new therapeutic strategy for urethral sphincter insufficiency is developed, has finished in October 2008.[52] Women and men aged 40-75 years suffering from urinary incontinence since at least six months and candidate for a surgical treatment (artificial urinary sphincter, synthetic compressive tapes or adjustable balloons) were enrolled in this trial. This study developed a new therapeutic strategy for stress urinary incontinence based on the implantation whole myofibers with satellite cells. The scientific background of this therapy relies on the activation *in vivo* of the satellite cells. Satellite cell activation is concomitant with myofiber death that occurs after their implantation. Activated satellite cells proliferate, fuse and form myotubes replacing the parental myofibers. It leads to the regeneration of the muscle volume. Preliminary studies on the pig model showed the regenerated muscle tissue in the urethra was innervated by urethral nerves and developed tonic contractions which acts like a new sphincter. This procedure does not include a phase of satellite cells amplification *ex vivo*, as standard methods of satellite cell transfer. Thus, the procedure of cell transfer into the urethra is considerably simplified and can be performed in one step in the operating room. This therapeutic strategy could represent an alternative method to the artificial urinary sphincter implantation.[52] Additionally two trials are open to test the efficacy and safety of autologous muscle derived cells transplantation. Eighteen years and older women, whose stress urinary incontinence symptoms had not improved within six months of conventional therapy are enroll. This study is currently recruiting participants.[53] The another attempt of SUI treatment was made by Mitterberger and coworkers, who investigated the injections of autologous myoblasts and fibroblasts. Twenty female patients, whom injected fibroblasts and myoblasts into the urethral submucosa and into the rhabdosphincter respectively, were included in this study. The authors reported that two years after SUI therapy, sixteen of eighteen patients were cured, two patients were improved, and two patients were lost to follow-up. Moreover, observations after therapy revealed that thickness of urethra and rhabdosphincter were significantly increased.[54] Despite many objections against quoted work, it has to be treated with a grain of salt, but this work was written and published and it's hard to deny it's accuracy.

Why cell therapy can fail?

Tissue engineering techniques hold promise for the future in SUI treatment. Unfortunately, aforementioned results have a number of weaknesses that should be clarified. A number of challenges however still need to be overcome. *In vitro* studies on autologous stem cell differentiation have some limitations. Biochemical characteristic of stem cells do not necessarily translate to *in vivo* usefulness and the *in vitro* findings may not mimic the signal transduction pathway that occurs in host.[42] The presence of some antigens may change *in vitro*, due to specific culture condition and the duration prior to individual passages. Some antigens may be found on freshly isolated mesenchymal stem cells, but their expression disappears in culture[55,56,57,58]. Furthermore such *in vitro* conditions can activate the DNA damage and may lead to a senescence phenotype.[59] A further questions arises, whether the grafted stem cells can maintain their undifferentiated state and build new niches, thus supporting the therapeutic effect on a long term basis.[55] It has also been observed that mesenchymal stem cells may differentiate into unwanted phenotypes *in vivo* such as osteocytes and adipocytes which are undesirable for therapeutic application in the muscle repair.[60] Some observations indicate on fusion of mesenchymal stem cells and endogenous differentiated cells *in vivo*, although it's extremely rare event.[55,61] For clinical applications, the choice of stem cells must have a high regenerative potential, however, it is not known whether single or multiple injections would be sufficient to achieve a stable functional improvement over a given time period. Moreover, homing mechanisms are not well defined, thus it is unclear whether systemic or direct graft administration of stem cells to the target organ would be most effective.[61] Another issue that needs to be addressed before the administration of functional cell populations *in vivo* is the type and number of viable cells injected delivered at the graft site and the prevention of neoplasm formation due to contamination of the graft with remaining undifferentiated cells or potentially embryonic like cells.[62,63] It has been shown that *in vitro* expansion affects the stem cells differentiation capabilities and regenerative potential.[61,64,65,66]

CONCLUSIONS

The current gold standard for the treatment of SUI is to surgically lift and reposition the urethra with a sling, supporting the muscles and ligaments of the middle urethra. Experimental stem cell injection therapy has the potential to restore the contractile response of the rhabdosphincter and has been at the forefront of incontinence research. However, the available data is derived from studies with small treatment groups. Furthermore, we still do not know whether the grafted stem cells can maintain their undifferentiated state or differentiate into unwanted phenotypes. The way of stem cells administration is not specified as well. All aforementioned issues related with stem cell therapy indicate that it is very promising. Nevertheless, additionally studies with significantly larger groups are required for proof of this concept.

REFERENCES

1. Norton P, Brubaker L: Urinary incontinence in women. Lancet 2006; 367:57-67.
2. Hampel C, Wienhold D, Benken N, Eggersmann C, Thüroff JW: Prevalence and natural history of female incontinence. Eur Urol 1997; 32(2 suppl):3-12.

3. Abrams P, Cardozo L, Fall M, Griffiths D, Rosier P, Ulmsten U, van Kerrebroeck P, Victor A, Wein A: The standardization of terminology in lower urinary tract function: report from the standardisation sub-committee of the International Continence Society. Urology 2003; 61:37-49.
4. Brown JS, Nyberg LM, Kusek JW, Burgio KL, Diokno AC, Foldspang A, Fultz NH, Herzog AR, Hunskaar S, Milsom I, Nygaard I, Subak LL, Thom DH: Proceedings of the National Institute of Diabetes and Digestive and Kidney Diseases International Symposium on epidemiologic issues in urinary incontinence in women. Am J Obstet Gynecol 2003; 188:77-88.
5. Holroyd-Leduc JM, Straus SE: Management of urinary incontinence in women: scientific review. JAMA 2004; 291:986-95.
6. Lasserre A, Pelat C, Gueroult V, Hanslik T, Chartier-Kastler E, Blanchon T, Ciofu C, Montefiore ED, Alvarez FP, Bloch J: Urinary incontinence in French women: prevalence, risk factors, and impact on quality of life. Eur Urol 2009; 56:177-83.
7. Meyer S, Schreyer A, De Grandi P, Hohlfeld P: The effects of birth on urinary continence mechanisms and other pelvic-floor characteristics. Obstet Gynecol 1998; 92:613-8.
8. Sampselle CM, Miller JM, Mims BL, Delancey JO, Ashton-Miller JA, Antonakos CL: Effect of pelvic muscle exercise on transient incontinence during pregnancy and after birth. Obstet Gynecol 1998; 91:406-12.
9. Peschers U, Schaer G, Anthuber C, Delancey JO, Schuessler B: Changes in vesical neck mobility following vaginal delivery. Obstet Gynecol 1996; 88:1001-6.
10. Thom DH, van den Eeden SK, Brown JS: Evaluation of parturition and other reproductive variables as risk factors for urinary incontinence in later life. Obstet Gynecol 1997;90:983-9.
11. McGuire EJ, Lytton B, Pepe V, Kohorn EI: Stress urinary incontinence. Obstet Gynecol 1976; 47:255-64.
12. Kayigil O, Iftekhar Ahmed S, Metin A: The coexistence of intrinsic sphincter deficiency with type II stress incontinence. J Urol 1999; 162:1365-6.
13. Smaldone MC, Chancellor MB: Muscle derived stem cell therapy for stress urinary incontinence. World J Urol 2008; 26:327-32.
14. Xiao-fei S, Qiang F, Yue-min X: Application of tissue engineering in the treatment of stress urinary incontinence. Chin Med J 2009; 122:571-6.
15. Martins FE, Bovd SD: Artificial urinary sphincter in patients following major pelvic surgery and/or radiotherapy: are they less favorable candidates? J Urol 1995; 153:1188-93.
16. Lightner D, Calvosa C, Andersen R, Klimberg I, Brito CG, Snyder J, Gleason D, Killion D, Macdonald J, Khan AU, Diokno A, Sirls LT, Saltzstein D: A new injectable bulking agent for treatment of stress urinary incontinence: results of a multicenter, randomized, controlled, double-blind study of durasphere. Urology 2001; 58:12-5.
17. Kiilholma P, Chancellor MB, Makinen J, Hirsch IH, Klemi PJ: Complications of Teflon injections for stress urinary incontinence. Neurourol Urodyn 1993; 12:131-7.
18. Guys JM, Fakhro A, Louis-Borrione C, Prost J, Hautier A: Endoscopic treatment of urinary incontinence: long-term evaluation of the results. J Urol 2001; 165:2389-91.
19. Chancellor MB, Yokoyama T, Tirney S, Mattes CE, Ozawa H, Yoshimura N, de Groat WC, Huard J: Preliminary results of myoblast injection into the urethra and bladder wall: a possible method for the treatment of stress urinary incontinence and impaired detrusor contractility. Neurourol Urodyn 2000; 19:279-87.
20. Yokoyama T, Pruchnic R, Lee JY, Chuang YC, Jumon H, Yoshimura N, de Groat WC, Huard J, Chancellor MB: Autologous primary muscle-derived cells transfer into the lower urinary tract. Tissue Eng 2001; 7:395-404.
21. Lee JY, Cannon TW, Pruchnic R, Fraser MO, Huard J, Chancellor MB: The effects of periurethral muscle-derived stem cell injection on leak point pressure in a rat model of stress urinary incontinence. Int Urogynecol J Pelvic Floor Dysfunct 2003; 14:31-7.
22. Furuta A, Carr LK, Yoshimura N, Chancellor MB: Advances in the understanding of stress urinary incontinence and the promise of stem-cell therapy. Rev Urol 2007; 9:106-12.
23. Caplan AI: Mesenchymal stem cells. J Orthop Res 1991; 9:641-50.
24. Watt SM, Contreras M: Stem cell medicine: umbilical cord blood and its stem cell potential. Semin Fetal Neonatal Med 2005; 10:209-20.
25. Zuk PA, Zhu M, Mizuno H, Huang J, Futrell JW, Katz AJ, Benhaim P, Lorenz HP, Hedrick MH: Multilineage cells from human adipose tissue: implications for cell-based therapies. Tissue Eng 2001; 7:211-28.
26. Toma JG, McKenzie IA, Bagli D, Miller FD: Isolation and characterization of multipotent skin-derived precursors from human skin. Stem Cells 2005; 23:727-37.
27. De Bari C, Dell'Accio F, Luyten FP: Human periosteum-derived cells maintain phenotypic stability and chondrogenic potential throughout expansion regardless of donor age. Arthritis Rheum 2001; 44:85-95.
28. Gronthos S, Brahim J, Li W, Fisher LW, Cherman N, Boyde A, DenBesten P, Robey PG, Shi S: Stem cell properties of human dental pulp stem cells. J Dent Res 2002; 81:531-5.
29. Lee JY, Paik SY, Yuk SH, Lee JH, Ghil SH, Lee SS: Long-term effects of muscle-derived stem cells on leak point pressure and closing pressure in rats with transected pudendal nerves. Mol Cells 2004; 18:309-13.
30. Yokoyama T, Yoshimura N, Dhir R, Qu Z, Fraser MO, Kumon H, de Groat WC, Huard J, Chancellor MB: Persistence and survival of autologous musle derived cells versus bovine collagen as potential treatment of stress urinary incontinence. J Urol 2001; 165:271-6.
31. Oshima H, Payne TR, Urish KL, Sakai T, Ling Y, Gharaibeh B, Tobita K, Keller BB, Cummins JH, Huard J: Differential myocardial infarct repair with muscle stem cells compared to myoblasts. Mol Ther 2005; 12:1130-41.
32. Huard J, Yokoyama T, Pruchnic R, Qu Z, Li Y, Lee JY, Somogyi GT, de Groat WC, Chancellor MB: Muscle-derived cell mediated ex vivo gene therapy for urological dysfunction. Gene Ther 2002; 9:1617-26.
33. Rodriguez LV, Alfonso Z, Zhang R, Leung J, Wu B, Ignarro LJ: Clonogenic multipotent stem cells in human adipose tissue differentiate into functional smooth musle cells. Proc Natl Acad Sci U S A 2006; 103:12167-72.
34. Jack GS, Almeida FG, Zhang R, Alfonso ZC, Zuk PA, Rodríguez LV: Processed lipoaspirate cells for tissue engineering of the lower urinary tract: implications for the treatment of stress urinary incontinence and bladder reconstruction. J Urol 2005; 174:2041-5.
35. Pittenger MF, Mackay AM, Beck SC, Jaiswal RK, Douglas R, Mosca JD, Moorman MA, Simonetti DW, Craig S, Marshak DR: Multilineage potential of adult human mesenchymal stem cells. Science 1999; 284:143-7.
36. Ferrari G, Cusella-De Angelis G, Coletta M, Paolucci E, Stornaiuolo A, Cossu G, Mavilio F: Muscle regeneration by bone marrow-derived myogenic progenitors. Science 1998; 279:1528-30.
37. Prockop DJ: Marrow stromal cells as stem cells for non-hematopoietic tissues. Science 1997; 276:71-4.
38. Dezawa M, Ishikawa H, Itokazu Y, Yoshihara T, Hoshino M, Takeda S, Ide C, Nabeshima Y: Bone marrow stromal cells generate muscle cells and repair muscle degeneration. Science 2005; 309:314-7.
39. Furuta A, Jankowski RJ, Honda M, Pruchnic R, Yoshimura N, Chancellor MB: State of the art of where we are at using stem cells for stress urinary incontinence. Neurourol Urodyn 2007; 26:966-71.
40. Bossolasco P, Corti S, Strazzer S, Borsotti C, Del Bo R, Fortunato F, Salani S, Quirici N, Bertolini F, Gobbi A, Deliliers GL, Pietro Comi G, Soligo D: Skeletal muscle differentiation potential of human adult bone marrow cells. Exp Cell Res 2004; 295:66-78.
41. Balana B, Nicoletti C, Zahanich I, Graf EM, Christ T, Boxberger S, Ravens U: 5-Azacytidine indu ces chan ges In electrophysiological properties of human mesenchymal stem cells. Cell Res 2006; 16:949-60.
42. Gimble JM, Guilak F, Nuttall ME, Sathishkumar S, Vidal M, Bunnell BA: In vitro differentiation potential of mesenchymal stem cells. Transfus Med Hemother 2008; 35:228-38.
43. Grove JE, Bruscia E, Krause DS. Plasticity of bone marrow-derived stem cells. Stem Cells 2004; 22:487-500.
44. Peng H, Huard J: Muscle-derived stem cells for musculoskeletal tissue regeneration and repair. Transpl Immunol 2004; 12:311-9.

45. Engler AJ, Sen S, Sweeney HL, Discher DE: Matrix elasticity directs stem cell lineage specification. Cell 2006;126:677-89.
46. Cannon TW, Lee JY, Somogyi G, Pruchnic R, Smith CP, Huard J, Chancellor MB: Improved sphincter contractility after allogenic muscle-derived progenitor cell injection into the denervated rat urethra. Urology 2003; 62:958-63.
47. Kwon D, Kim Y, Pruchnic R, Jankowski R, Usiene I, de Miguel F, Huard J, Chancellor MB: Periurethral cellular injection: comparison of muscle-derived progenitor cells and fibroblasts with regard to efficacy and tissue contractility in an animal model of stress urinary incontinence. Urology 2006; 68:449-54.
48. Cannon TW, Sweeney DD, Conway DA, Kamo I, Yoshimura N, Sacks M, Chancellor MB: A tissue-engineered suburethral sling in an animal model of stress urinary incontinence. BJU Int 2005; 96:664.
49. Chermansky CJ, Tarin T, Kwon DD, Jankowski RJ, Cannon TW, de Groat WC, Huard J, Chancellor MB: Intraurethral muscle-derived cell injections increase leak point pressure in a rat model of intrinsic sphincter deficiency. Urology 2004; 63:780-5.
50. Zeng X, Jack GS, Zhang R, Wu B, Rodriguez LV: Treatment of SUI using adipose derived stem cells: restoration of urethral function. J Urol 2006; 175:291.
51. Carr LK, Steele D, Steele S, Wagner D, Pruchnic R, Jankowski R, Erickson J, Huard J, Chancellor MB: 1-year follow-up of autologous muscle-derived stem cell injection pilot study to treat stress urinary incontinence. Int Uroqvnecol J Pelvic Floor Dysfunct 2008; 19:881-3.
52. ClinicalTrials.gov identifier: NCT00472069
53. ClinicalTrials.gov identifier: NCT00847535
54. Mitterberger M, Pinggera GM, Marksteiner R, Margreiter E, Fussenegger M, Frauscher F, Ulmer H, Hering S, Bartsch G, Strasser H: Adult stem cell therapy of female stress urinary incontinence. Eur Urol 2008; 53:169-75.
55. Bobis S, Jarocha D, Majka M: Mesenchymal stem cells: characteristics and clinical applications. Folia His Cytobiol 2006; 44:215-30.
56. Dazzi F, Ramasamy R, Glennie S, Jones SP, Roberts I: The role of mesenchymal stem cells in haemopoiesis. Blood Rev 2006;20:161-71.
57. Fibbe WE, Noort WA: Mesenchymal stem cells and hematopoietic stem cells transplantation. Ann NY Acad Sci 2003; 996:235-44.
58. Honczarenko M, Lee Y, Skierkowski M, Ghiran I, Glodek AM, Silberstein LE: Human bone marrow stromal cells express a distinct set of biologically functional chemokine receptors. Stem Cells 2006; 24:1030-41.
59. Galderisi U, Helmbold H, Squillaro T, Alessio N, Komm N, Khadang B, Cipollaro M, Bohn W, Giordano A: In vitro senescence of rat mesenchymal stem cells is accompanied by downregulation of stemness-related and DNA damage repair genes. Stem Cells Develop 2009; 18:1033-41.
60. Mimeault M, Batra SK: Recent progress on tissue-resident adult stem cell biology and their therapeutic implications. Stem Cell Rev 2008; 4:27-49.
61. Bongso A, Fong CY, Gauthaman K: Taking stem cells to the clinic: major challenges. J Cell Biochem 2008; 105:1352-60.
62. Ratajczak MZ, Kucia M, Ratajczak J, Zuba-Surma EK: A multi-instrumental approach to identify and purify very small embryonic like stem cells (VSELs) from adult tissues. Micron 2009; 40:386-93.
63. Choumerianou DM, Dimitriou H, Kalmanti M: Stem cells: promises versus limitations. Tissue Eng B 2008; 14:53-60.
64. Bianchi G, Murgalia A, Daga A, Corte G, Cancedda R, Quarto R: Microenvironment and stem properties of bone marrow-derived mesenchymal cells. Wound Rep Reg 2001; 9:460-6.
65. DiGirolamo CM, Stokes D, Colter D, Phinney DG, Class R, Prockop DJ: Propagation and senescence of human marrow stromal cells in culture: a simple colony-forming assay identifies samples with the greatest potential to propagate and differentiate. Br J Haematol 1999; 107:275-81.
66. Payushina OV, Damaratskaya EI, Starostin VI: Mesenchymal stem cells: sources, phenotype, and differentiation potential. Cell Biol 2006; 1:6-25.

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Original article

Safe and effective intervention surgery for pelvic organ prolapse with CR-Mesh® kit: a comparative study from United Kingdom and Italy

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Abstract: Background: Surgical approach for the treatment of genital prolapse remains subject of controversy. The aim of pelvic surgery is to relieve symptoms, to correct the prolapse and to improve the quality of life. Objective: To compare success rates, intraoperative and postoperative complications, safety, functional outcome and satisfaction rate in a UK and an Italy group in a retrospective case series using CR Mesh® kit[19] for the management of vaginal prolapse over the first year. Materials and Method: This is a prospective, observational study of 40 women in each arm and 80 patients in total, operated in the period from October 2008 to December 2010. In this study, we compared data from our audit (UK Group) with data from our Italian colleague (Italy Group). All the surgeons received their surgical training for this repair from the same trainers. This comparative study is undertaken as all the surgeons received similar surgical training. The results were collected and checked compliance against NICE interventional procedure guidelines No.267 audit support. Results: The preliminary audit confirms the intra-operative safety and efficacy of the procedure with no intra-operative and post-operative complications. Anatomical restoration was successfully achieved in 95-100% of patients. Re-operation rate was 2.5% in UK group. There were no mesh erosions noted in both the groups after one year. 90% of the patients were satisfied with improvement in functional outcome concerning urinary, bowel symptoms and sexual function and improvement in quality of life whilst the dissatisfaction rate was 10%. Conclusion: Pelvic floor reconstruction with CR Mesh procedure safely addresses repair of POP and is compliant with standards defined by NICE.[25] It is one of the first case series of its kind with medium term follow-up for this procedure.

Key words: CR Mesh; Pelvic Organ Prolapse, Pelvic floor reconstruction.

INTRODUCTION

POP occurs in up to 50% of parous woman. Up to 30% of all females suffer from pelvic floor relaxation to a degree that has negative impact upon their quality of life. Olsen et al.[1] estimated that the lifetime risk (up to age 80 years) of undergoing surgery for vaginal prolapse was 11%. 29% to 40% of the prolapse surgery is for recurrence[1,2] and the prolapse is at the site of the original procedure in 60% of re-operations.[3]

Pelvic organ prolapse (POP) is nothing but herniation of viscera through the weakened pelvic floor and vaginal walls. Cystocele and urethrocele are herniation due to a defect in the anterior compartment. Cervical, uterine and vault prolapse are herniation due to a defect in the central compartment. Enterocele, rectocele and perineal body deficiency are herniation due to a defect in the posterior compartment (Figure 1).

It is important to understand the supports of the pelvis before embarking on the prolapse repair. There are three levels of supports in the pelvis. Main function of Level I is suspension, Level II is attachment and Level III is fusion (Figure 2).

Table 1 describes the structures in detail. Identifying the defect and offering a side-specific and site-specific repair is a prerequisite for a successful and long lasting effect. The aim of any pelvic surgery is to restore the anatomical and functional defect, relieve symptoms and improve the patient's quality of life with minimum morbidity from the surgery.

Nevertheless, what is "cure" and how are we to define it? A woman presenting with a prolapse seldom asks for an "anatomical cure". What she wants is a resolution of her symptoms of a vaginal lump as well as a resolution of any associated bowel and bladder dysfunction. [6] Therefore, the choice of surgery depends on the patient's symptoms, associated pelvic defects and underlying medical conditions. The choice of course, is heavily dependent on the training, expertise and experience of the individual surgeon.[7,8] Abdominal sacro-colpopexy has remained the gold standard for the repair of vaginal apical suspension defects.[9] Vaginal approach is less invasive with lesser patient morbidity and has fewer side-effects/complications.

POP non-mesh reconstruction entails unacceptably high recurrence rate, thus mesh augmentation is indicated for long lasting prolapse cure. This also avoids hysterectomy of the prolapsed uterus.[10] Having said that, surgical approach for the treatment of genital prolapse with large mesh remains controversial and the outcomes, major complications and improvement in quality of life remain at its infancy.[11] Currently, most of the information on the outcomes of vaginal surgery with synthetic mesh implants comes from short-term follow-up[12,13,14] or exists in non-peer review publications such as conference abstracts.[15, 16]

Pelvic floor mesh reconstruction involves extensive deep pelvic dissection. Hence, it is mandatory that surgeons are thoroughly familiar with the anatomy, accurate surgical technique, potential hazards, preventive measures and management of complications before embarking on the implantation of such meshes. It is suggested that surgeons undergo a meticulous training program with an expert prior to undertaking the procedure[17] and maintain skills with frequent operation performance.[17, 18]

OBJECTIVE

To compare success rates, intraoperative and postoperative complications, safety, functional outcome and satisfaction rate in a UK and an Italy group in a prospective, observational case series using CR Mesh® kit[19] for the management of vaginal prolapse over the first year.

MATERIALS AND METHODS

CR Mesh[20]

CR Mesh (Figure 3) is designed to restore fascial support to either the anterior or the posterior vaginal compartment. It has a number of features, which are designed to make it

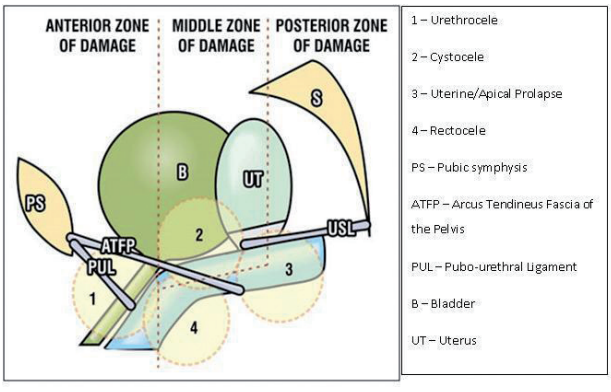

Figure 1. – (The Integral Theory System[4]) – Zones of damage and anatomical changes.

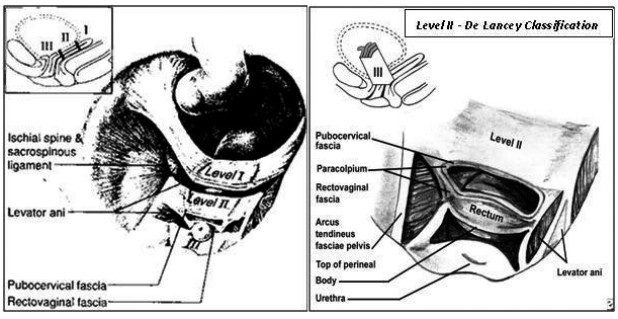

Figure 2. – Three Levels of Pelvic Support[5].

less likely to cause mesh related complications after surgery. These features are advances from previous techniques that have proven to be successful in reducing the risk of mesh related complications. The features include:

- Lightweight low-density monofilament mesh structure- The main body of the mesh is composed of a very low-density wide weave macroporous monofilament polypropylene.
- Strong non-distensible upper vaginal slings for firm lateral attachment.
- Independent attachment of mesh components - No glue, sutures or rivets left within the patient.
- Complete flexibility and adjustability to customise mesh for each patient – Adjustable length of the mesh.
- The mesh is tailored to fit the patient rather than the patient is made to fit the mesh.

There are several mesh kits available in the market to restore pelvic anatomy. However, most of them do not address Level I pelvic organ prolapse similar to CR Mesh. CR Mesh® kit[20] is now available in Europe and Australia for advanced pelvic floor surgeons who complete a training program. The technique is more complex and difficult than standard techniques using available meshes. However, this results in a superior anatomical restoration due to the accurate recreation of the pelvic anatomy.

POP Repair With CR Mesh[20]

The procedure for implanting the CR Mesh is as described by Dr. B. Farnsworth[21] and it is not within the context of this paper to discuss the procedure in detail. The important steps in the procedure are:

1. **Level I - Apical support -** Provided by a suture suspended between the top of the mesh and the medial end of the sacrospinous ligament. The origin of the uterosacral ligaments is recreated by attaching the apical support to a point at the medial end of the sacrospinous ligament within a few millimetres of the sacrum on each side. High apical suspension accurately recreates the uterosacral ligaments.
2. **Level II - Lateral support -** Provided by the sling arms for either the anterior vaginal walls (cystocele) or the posterior vaginal wall (rectocele), depending on their placement. Firm lateral attachments with permanent muscle fixation - lateral fixation to the obturator foramen anteriorly and the levator complex posteriorly ensures that upper vaginal support is restored.
3. **Level III - Distal support -** Provided by 2 distal mesh extensions, tunnelled at the level of the obturator foramen anteriorly and around the perineal body posteriorly. This results in independent bladder neck and perineal reconstruction respectively- both the bladder neck and perineal body are directly reattached to the sacrum.

This is a prospective, observational study of 40 women in each arm and 80 patients in total, operated in the period from October 2008 to December 2010. In this study, we compared data from our audit (UK Group) with data from our Italian colleague (Italy Group). All the surgeons received their surgical training for this repair from the same trainers.[21,22] This comparative study is undertaken as all the surgeons received similar surgical training.

Case selection: patients experiencing stage 3 or 4 vaginal apical supportive defects, (Table 2) diagnosed clinically in accordance with the International Continence Society (ICS) Pelvic Organ Prolapse Quantification (POP-Q) (Figure 4) standard scoring system, were offered CR Mesh repair.

Standards: We benchmarked our performance against The National Institute for Health and Clinical Excellence (NICE), UK guidelines[11]. NICE is an independent organisation responsible for providing national guidance on promoting good health and preventing and treating ill health. NICE makes recommendations on the safety and efficacy of a procedure and presents recommendations in a suitable

TABLE 1. – Three Levels of Pelvic Support[5].

Levels	Function	Area/Tissue	Attachments	POP
Level I	Suspension	Parametrium Upper paracolpium	Cardinal L Uterosacral L	Uterine P Vault P
Level II	Attachment	Paracolpium Upper 2/3 of vagina	Pubocervical Rectovaginal Fascia (ATFP)	Cystocele Enterocele Rectocele
Level III	Fusion	Levator plate Perineal body Lower 1/3 of vagina	Pubococcygeus Ileococcygeus	Urethrocele Low rectocele Deficient Perineal body

TABLE 2. – POP-Q system[24].

Stage 0	No descent of pelvic structures during straining
Stage I	Leading edge of the prolapse is < 1 cm above the hymenal ring
Stage II	Leading edge of the prolapse extends from 1 cm above the hymen to 1 cm below the hymen.
Stage III	Leading edge of the prolapse is > 1 cm below the hymen, but there is no complete vaginal eversion.
Stage IV	The vagina is completely everted

Table 3.

Demographics	UK Group
Age – Range (Mean)	47-81 years (67.4)
Body Mass Index - Range (Mean)	23-43 (29.5)
Parity - Range (Mean)	1-7 (3.03)
Associated medical disorders: Diabetes, asthma, hypertension etc	90%
Sexually active	10% sexually active

Table 4.

Previous Surgery	UK Group (%)
None	55%
Abdominal hysterectomy	17.5%
Vaginal Repair	12.5%
Vaginal hysterectomy	5%
Burch Colposuspension	5%
Laparoscopic hystero/colpopexy	5%
Sacrospinous Fixation	2.5%
Prolift Repair	2.5%

Table 5.

Vaginal Mass/Bulge	UK Group (%)
Bulge/Lump in the vagina	90%

Table 6.

Bowel Symptoms	UK Group (%)
Need for digital evacuation	2.5%
Constipation – Difficulty in emptying bowels	25%

format for health professionals. NICE Guidance[11] was used as gold standard to assess our study. The outcome measures were checked for compliance against NICE audit support[25].

Outpatient consultation: patients were referred by their general practitioners with a history of pelvic organ prolapse that had recurred or occurred for the first time. Patients were assessed gynaecologically for the associated signs and symptoms and a POP-Q was performed on each patient at the first visit. Demographics, sexual activity, previous vaginal repair, vaginal mass, bladder and bowel specific symptoms were collected.

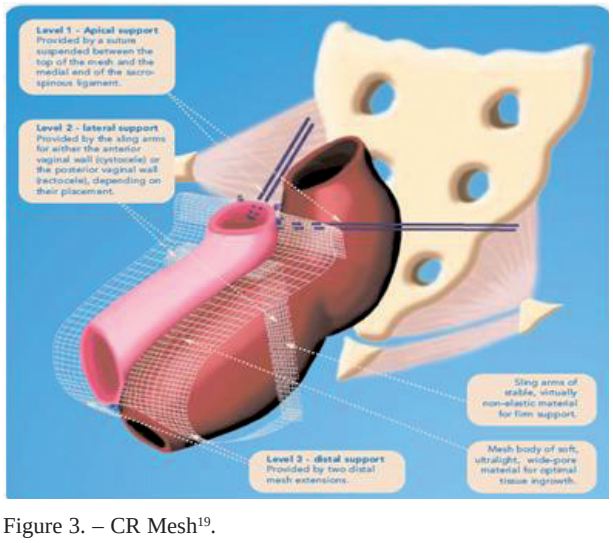

Figure 3. – CR Mesh[19].

Table 7.

Bladder Symptoms	UK Group (%)
Urge Incontinence	27.5%
Urgency	17.5%
Hesitancy	2.5%
Weak stream	2.5%
Incomplete emptying	7.5%
Stress Incontinence	50%

Table 8.

POP - Q measurements	UK Group - Range (Median)
Anterior	
Aa	2.5 (–3 to 3)
Ba	2.0 (–2 to 4)
Stage	3 (2 to 3)
Posterior	
Ap	–2.5 (–3 to 2)
Bp	–2 (–3 to 1)
Stage	2 (1 to 3)
Middle	
C	–5 (–9 to 5)
D	–6 (–8 to –4)
Stage	2 (0 to 3)
gh (genital hiatus)	5 (2 to 6)
Pb (perineal body)	2.5 (2 to 5)
tvl (total vaginal length)	8.5 (7 to 10)

Once stage 3 or 4 vaginal apical supportive defect was confirmed, the procedure, risks and complications including mesh erosion were explained and informed consent was obtained. Patients received explanation that the technique is recent and long-term data is not available.

There is a slight difference in the selections of patients. In The UK group, this was offered to women who were not sexually active. However, the procedure was offered to 10% of sexually active women as these women had several other surgical procedures that had failed. In the Italy group, the procedure was offered to patients regardless of their sexual activity.

Demographic features and previous surgical history in UK group are summarized in Tables 3 and 4. In Italy group, age range was 38-74 years, with mean of 55.5 years. 75% of this group were sexually active.

Tables 5, 6, and 7 demonstrate symptoms in the UK group while Table 8 reports POP-Q measurements. In Italy group, 50% women complained of bulge/lump in the vagina, 7.5% complained of bowel dysfunction, 12.5% had symptoms of overactive bladder and 15% had stress incontinence.

Investigations: apart from routine pre-operative investigations, in the UK group, urodynamic assessment were performed on patients with urinary symptoms, whereas in the Italy group, urodynamics and proctograms were performed on patients with urinary or bowel dysfunction respectively.

Operation: all patients received 1.2 gram Co-amoxiclav intravenously at the induction of anaesthesia and continued on oral co-amoxiclav for seven days post-operatively. Surgical area was prepared by iodine antiseptic vaginal wash prior to commencement of surgery. Adhesive plastic sheet was attached below the level of vaginal fourchette to prevent any contamination from perianal region. Vaginal tissues were liberally infiltrated with a 0.25% solution of bupivacaine with adrenaline 1:200,000 prior to dissection. (Up to 40 ml of solution was diluted in 100 ml of normal saline). An indwelling catheter and lubricated vaginal pack

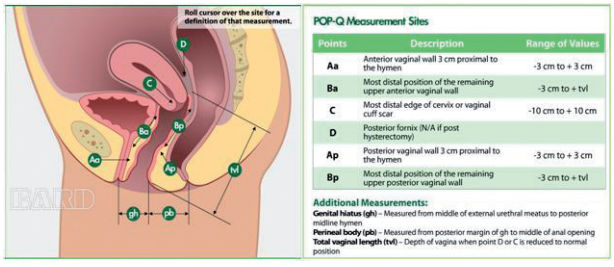

Figure 4 - Pelvic Organ Prolapse Quantification (POP-Q) Standard scoring system[23].

were inserted after the procedure, which were removed 24 hours later. In cases of suspected retention of urine, residual urine was measured by in and out catheter following emptying of the bladder by the patient. Patients who had posterior CR Mesh almost inevitably showed marked perineal bruising because of the very nature of the procedure. Full blood count was performed on second post-operative day unless indicated otherwise. Women were discharged on second post-operative day. Operative details, intra-operative and post-operative complications of all the patients were collected.

Post-operative follow-up: postoperatively, patients in the UK arm were reviewed at 4 weeks where mesh erosion, urinary, bowel symptoms, pain, vaginal discharges were assessed. In the Italian arm, patients were reviewed clinically at three monthly intervals for one year and with urodynamics and proctogram at their six-month visit. In both the groups, quality of life assessment questionnaires were sent to patients between six months to one year following surgery.

The numbers and types of procedure performed are shown in Table 9. In the UK group, 19 patients had anterior CR mesh, 11 had posterior CR mesh and 10 patients had total CR mesh (anterior and posterior mesh) whilst in the Italian Group, 15 patients had anterior CR mesh, 15 patients had posterior CR mesh and 10 patients had total CR mesh procedure.

TABLE 9.

Types of procedure performed	UK Group n (%)	Italy Group n (%)
Anterior CR Mesh procedure	19 (47.5%)	15 (37.5%)
Posterior CR Mesh	11 (27.5%)	15 (37.5%)
Total CR Mesh (Anterior and Posterior Mesh)	10 (25%)	10 (25%)

RESULTS

Assessed against NICE Criteria[25]

When analysing the results of the criteria 3, 5, 6, 7 and 8, NICE recommends that consideration be given to the type of prolapse, whether it is a first or recurrent prolapse, whether there have been previous repairs and any underlying medical conditions or comorbidities. Results should also be analysed by type of mesh used and approach. Patients who lost follow-up should be excluded from the study. However, no patients were lost for follow-up in both UK and Italy group.

Criterion 1: The % of patients receiving surgical repair of vaginal wall prolapse using mesh within a given period who have (A) Received written information on the procedure and any possible complications (B) Had a discussion with the clinician about the procedure which is documented in the notes and (C) Given written consent to treatment.

Definition: Specific information regarding the treatment should be provided including reference to complications of sexual dysfunction and erosion into the vagina, which would require additional procedures. Success rates should also be provided.

TABLE 10. – Summary - Outcome compared with NICE Guidelines[25].

Criteria	NICE Standard	UK Group	Italy Group
Criterion 1			
% of patients receiving (A) received written information on the procedure and any possible complications, (B) had a discussion with the clinician about the procedure which is documented in the notes and (C) given written consent to treatment	(A)100% (B) 100% (C) 100%	(A) 0% (B) 100% (C) 100%	(A) 0% (B) 100% (C) 100%
Criterion 2			
% of patients whose surgery is undertaken by a gynaecologist with special expertise in the surgical management of pelvic organ prolapse	100%	100%	100%
Criterion 3			
% of patients with clinical or symptomatic improvement compared to baseline at 6 and 12 months – Objective failure rate	9%-23%	10%	0%
Criterion 5			
% of patients who require further re-operation for recurrent or de novo prolapse due to failure of repair within 1 year of the procedure	1%-9%	2.5%	0%
Criterion 6			
% of patients who have an assessment of their quality of life at t 1 year	100%	100%	100%
Criterion 7			
% of patients who suffer intraoperative and complications within 30 days post procedure (Reported complications include bladder injury, urethral or rectal perforation and damage to other surrounding organs)	Insufficient evidence to set a standard	0%	0%
Criterion 8			
% of patients who suffer any of the following complications within 12 months post procedure			
• Mesh erosion	<10%	0%	0%
• Urinary or faecal incontinence	<15%	2.5%	2.5%
• De novo dyspareunia	<10%	0%	0%
• Vaginal narrowing secondary to mesh	–	0%	0%
• Vaginal pain	–	2.5%	0%
• Chronic sepsis, discharge	–	0%	0%
• Fistula	–	0%	0%

Standard: NICE recommends 100% compliance.

Results: Compliance was 100% in UK group for points (B) and (C). Detailed patient information leaflets were not available regarding the procedure. Compliance was 100% in all areas in Italy group.

Criterion 2: The % of patients receiving surgical repair of vaginal wall prolapse using mesh within a given period whose surgery is undertaken by a gynaecologist with special expertise in the surgical management of pelvic organ prolapse.

Definition: The British Society of Urogynaecologists define a urogynaecologist as having a surgical workload of at least one major urogynaecology procedure associated with pelvic floor dysfunction (i.e. incontinence and/or prolapse) per working week per year.

Standard: NICE recommends 100% compliance.

Results: Compliance was 100% in both UK and Italy groups. The operators had performed more than 80 procedures per year for vaginal prolapse and/or incontinence procedure annually.

Criterion 3: The % of patients receiving surgical repair of vaginal wall prolapse using mesh for which there was a clinical and symptomatic improvement compared to baseline at 6 months and 1 year

Definitions: The POP-Q is recommended as an objective measure for clinical outcome. It reports outcome as four stages and clinical improvement is defined as a transition to at least one stage lower than baseline.

Standard: NICE recommends objective failure rates between 9% and 23%; insufficient evidence to set a standard

Results: In the UK Group, the dissatisfaction rate with the operation or outcome was 10% whilst in the Italy group; all patients were satisfied with the outcome. Thus, our results from both the groups were within the objective failure rate. Studies with CR Mesh showed that 90% of the patients were satisfied with the results and had an improvement of quality of life[26].

Criterion 5: (There are no Criteria 4 in NICE standards) The % of patients receiving surgical repair of vaginal wall prolapse using mesh who require further re-operation for recurrent or de novo prolapse due to failure of repair within 1 year of the procedure.

Definition/Standard: Re-operation rates between 1% and 9% were reported across different types of mesh at a mean follow-up of 1.5 years; insufficient evidence to set a standard.

Results: In the UK group, 5% of the patients required a further procedure. However, only 2.5% were for the recurrence of Level 1 prolapse and 2.5% was due to a prolapse in a different compartment. There were no re-operations in the Italian group within 18 months.

Criterion 6: The % of patients receiving surgical repair of vaginal wall prolapse using mesh who have an assessment of their quality of life at 1 year.

Definitions: Assessment of quality of life provides some indication as to the success of the treatment from the patient perspective.

Standard: NICE recommends 100% compliance.

Results: Compliance was 100% in both UK and Italy groups.

Criterion 7: The % of patients receiving surgical repair of vaginal wall prolapse using mesh who suffer: Intraoperative complications and complications within 30 days post procedure.

Definitions: Complications include bladder injury, urethral or rectal perforation, and damage to other surrounding organs.

Standard: NICE had insufficient evidence to set a standard.

Results: Compliance was 100% in both UK and Italy groups. There were no intraoperative complications or complications within 30 days of the surgery in both the groups.

Criterion 8: The % of patients who suffer any of the following complications within 12 months post procedure which include mesh erosion, urinary or faecal incontinence. de novo dyspareunia, vaginal narrowing secondary to mesh, vaginal pain, chronic sepsis, discharge and fistula

Definitions: Mesh erosion occurred in 6% regardless of the mesh type, de novo urinary incontinence in 10% of women, de novo dyspareunia in 7% following surgery using combined mesh and 12.8% following surgery using non-absorbable synthetic mesh. **Standard:** NICE recommends mesh erosion <10%, urinary incontinence <15% and dyspareunia <10%

Results: Mesh erosion: In the UK group, two (5%) patients had mesh erosion at the 4-week visit and they were asymptomatic. Mesh erosion was noted on the incision line on the posterior vaginal wall, which was not healed completely. Further follow-up at 8 weeks visit revealed well-healed scar and there was no erosion noted. There were no mesh erosions detected in both groups after 1 year and this is comparable against NICE standards. Refraining from excessive vaginal mucosa trimming and dissecting below the sub-mucosal fascia preserves blood supply and nerve endings. Thus, ischaemia, poor healing and tissue necrosis are avoided and likelihood of mesh exposure is reduced[27].

Urinary incontinence: We reported one (2.5%) case of residual urinary incontinence in both the groups 12 months following surgery. Once again, this was comparable with NICE standard and compliance was 100% in both UK and Italy groups. Nonetheless, 6 (15%) patients in both groups complained of urge incontinence and frequency immediately after surgery, which resolved with anticholinergics and/or antibiotic therapy within 4 weeks. In 1 (2.5%) patient in UK group, the obturator arms of the anterior CR mesh were divided at level III after six months following initial repair, as excessive compression of the urethra resulted in difficulty in micturition and recurrent urinary tract infections.

Dyspareunia: In sexually active patients, there were no complaints of de novo dyspareunia. Indeed, in the UK group, 8 (20%) of sexually inactive patients due to disrupted pelvic anatomy resumed sexual function after their surgery. 75% of patients in Italy group said there was an improvement in their sexual function following surgery due to absence of bulge or fear of incontinence.

Other complications: To date we did not have any complications of chronic sepsis, discharge or fistula. 25% patients complained of constipation initially after surgery but resolved following use of laxatives.

Other findings: although there are no standards provided by NICE guidelines regarding vaginal pain, 1 (2.5%) woman in the UK group complained of protracted vaginal pain resulting from mesh contracture, which was at the point of anchoring of the mesh to the sacrospinous ligament. Pain resolved on division of that part of the mesh. No such complications were noted in the Italy group.

DISCUSSION

We are well aware of some of the deficiencies in our paper. The numbers of patients in both groups were small be-

cause of selectivity of patients for this type of surgery with stage 3 or 4 vaginal apical supportive defects. Gynaecologists who perform a large number of prolapse and incontinence surgeries operated the patients; hence, it contributes to the low rate of major complications. As the study is small, further follow-up studies are required to demonstrate the safety of this procedure. Long-term follow-up studies are required to assess these findings further. Detailed patient information leaflets were developed following the audit in the UK group to achieve 100% compliance with Criteria 1.

CONCLUSION

Pelvic floor reconstruction with CR Mesh procedure safely addresses repair of POP and is compliant with standards defined by NICE.[25] It is one of the first case series of its kind with medium term follow-up for this procedure. The preliminary audit confirms the intra-operative safety and efficacy of the procedure with no intra-operative complications and there were no major complications resulting from surgery within 30 days. Anatomical restoration was successfully achieved in 95-100% of patients. Re-operation rate was 2.5% for recurrent prolapse in the UK group. There were no mesh erosions noted in both the groups after one year.

The procedure is associated with minimal morbidity with good improvement in the quality of life for the patients. 90% of the patients were satisfied with improvement in functional outcome concerning urinary, bowel symptoms and sexual function and improvement in quality of life whilst the dissatisfaction rate was 10%. We did not have any patients with chronic sepsis, discharge and fistula or de novo dyspareunia. Table 10 summarizes outcomes compared with NICE Guidance[25].

Surgical expertise, proper training before adopting new operation and maintaining skills with regular operations are essential to improve success rate and decreases complication and failure rates.

CONFLICT OF INTEREST: The authors declare that have not received any grants or financial support for the study and there is no conflict of interest.

REFERENCES

1. Olsen AL, Smith VJ, Bergstrom JO, Colling JC, Clark AL. Epidemiology of surgically managed pelvic organ prolapse and urinary incontinence; Obstet Gynecol 1997: 89: 501-6.
2. Marchionni M, Bracco GL, Checcucci V, Carabaneanu A, Coccia EM, Mecacci F, et al. True incidence of vaginal vault prolapse; Thirteen years of experience. J Reprod Med. 1999; 44: 679-84.
3. Clark AL, Gregory T, Smith VJ, Edwards R - Epidemiologic evaluation of reoperation for surgically treated pelvic organ prolapse and urinary incontinence Am J Obstet Gynecol 2003; 189: 1261-7.
4. The Integral Theory System: A simplified clinical approach with illustrative case histories; Peter E. Papa Petros (1, 2) Pelviperineology 2010: 29: 37-5; http://www.pelviperineology.org .
5. De Lancey JOL; Anatomic aspects of vaginal eversion after hysterectomy Am J Obstet Gynecol 1992; 166: 1717-28.
6. Pelvic organ prolapse repair with Prolift® mesh: a prospective study - Eva M. De Cuyper - Malcolm I. Frazer Pelviperineology 2009; 28: 82-88; http://www.pelviperineology.org.
7. Flynn BJ, Webster GD. Surgical management of the apical vaginal defect. Curr Opin Urol 2002; 12: 353-8.
8. Lovastis D, Drutz H. Vaginal surgical approach to vaginal vault prolapse: considerations of anatomic correction and safety; Curr Opin Obstet Gynecol 2003: 15: 435-7.
9. Maher C, Baessler K, Glazener CM et al. Surgical management of pelvic organ prolapses in women: a short version Cochrane review. Neurouro Urodyn 2008; 27: 3-12.
10. Menahem Neuman, Jacob Bornstein; Reconstruction of pelvic organ prolapse: the role of mesh implantation and the need for vaginal hysterectomy; Pelviperineology 2009; 28: 104-108.
11. Nice Guidelines IPG 267: Surgical repair of vaginal wall prolapsed using mesh: guidance, published June 2008.
12. Abdel-Fattah M, Ramsay I, West of Scotland Study G. Retrospective multicentre study of the new minimally invasive mesh repair devices for pelvic organ prolapse; BJOG 2008; 115: 22-30.
13. Fatton B, Amblard J, Debodinance P, Cosson M, Jacquetin B. Transvaginal repair of genital prolapse: preliminary results of a new tension-free vaginal mesh (Prolift technique) – a case series multicentric study. Int Urogynecol J Pelvic Floor Dysfunct 2007; 18: 743-52.
14. Altman D, Falconer C. Perioperative morbidity using transvaginal mesh in pelvic organ prolapse repair. Obstet Gynecol 2007: 109: 303-8.
15. Cosson M, Caquant F, Collinet P, Rosenthal C, Clave H, Debodinance P, et al. Prolift mesh (Gynecare) for pelvic organ prolapse surgical treatment using the TVM group technique: a retrospective study of 687 patients. Neurourol Urodyn 2005; 24: 401-598.
16. Cosson M, Rosenthal C, Clave H, Debodinance P, Garbin O, Berrocal J, et al. Prospective clinical assessment of the total transvaginal mesh (TVM) technique for treatment of pelvic organ prolapse: 6 and 12 months results. Int Urogynecol J Pelvic Floor Dysfunct 2006; 17: S139-40.
17. National Institute for health and clinical excellence guideline CG 40 Urinary incontinence: NICE guideline 2006.
18. Schultz DG: FDA Public Health Notification: Serious complication associated with trans-vaginal placement of surgical repair of pelvic organ prolapse and stress urinary incontinence 2008.
19. CR Mesh® is manufactured by A.M.I. Advanced Pelvic Floor System® A.M.I. Advanced Pelvic Floor System® GmbH, Feldkirch, Austria.
20. www.drbruce.com.au/crmesh.htm.
21. Dr Bruce Farnsworth is a Consultant Gynaecologist and Pelvic Reconstructive Surgeon at the Centre for Pelvic Reconstructive Surgery, Sydney Adventist Hospital, Wahroonga, Sydney, Australia.
22. Dr Daniele Grassi, Urologist consultant and pelvic floor reconstructive surgeon at the Hisperia Hospital, Modena, Italy.
23. Pelvic Organ Prolapse: An Interactive Guide is a registered trademark of Tim Peters and Company Inc. Copyright 2007 All rights reserved. Developed in consultation with Patrick Culligan, MD, Morristown NJ.
24. Bump RC, Mattiason A, Bo K et al. The standardisation of terminology of female pelvic organ prolapse and pelvic floor dysfunction; Am J Obstet Gynecol. 1996; 175: 13.
25. Nice Guidelines IPG 267: Surgical repair of vaginal wall prolapsed using mesh: audit support, June 2008.
26. Christian Fuenfgeld, Tettnang-Germany, Pelviperineology 2009; 28: 82-88 http://www.pelviperineology.org.
27. Newman M, Lavy Y; Reducing mesh exposure in Posterior Intra-Vaginal Slingplasty (PIVS) for vaginal apex suspension; Pelviperineology, 2007; 26: 117-21.

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Original article

Learning curve experience in tension-free vaginal tape and transobturator tape operations for the treatment of stress urinary incontinence

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Abstract: Objective: to compare short-term outcomes and intraoperative complications that arise within the learning period of tension-free vaginal tape (TVT) and transobturator tape (TOT) operations used in stress urinary incontinence. Material and method: In the present study, 50 patients were treated with TOT and 20 with TVT. An additional operation was performed on 32% of those who had TOT and 50% of those who had TVT. Results: No intraoperative complications have been encountered in TVT and TOT operations. Marked improvements were observed in both operation groups in IIQ-7 and UDI-6 quality of life surveys in the first and third postoperative months ($p<0.05$). Operation duration of TOT was found significantly shorter than that of TVT ($p<0.05$). There was not any significant difference between groups in terms of early postoperative complications like duration of hospital stay, urination dysfunction, leg pain and urinary tract infection ($p>0.05$). One patient who had TOT developed mesh erosion and one who had TVT developed globe vesical on postoperative day one. Conclusion: TVT and TOT are operations which produce similar short-term outcomes and the learning period of which can be overcome without complications by surgeons experienced in pelvic anatomy and surgery.

Key words: Stress urinary incontinence (SUI); Tension-free vaginal tape (TVT); Transobturator tape (TOT); Short-term outcomes; Complication.

INTRODUCTION

Although a multitude of surgical techniques have been developed for the treatment of stress urinary incontinence (SUI), an ideal method with high success and low complications rate could not have been established yet. Recently, two methods based on the principle of midurethral support have been popularly utilized. These two techniques, both of which are applied vaginally, are Transobturator Suburethral Tape (TOT) and Tension-free Vaginal Tape (TVT).[1] Although these two are comparable in terms of treatment success, complication rates, long-term efficiency, ease of application and learning curve, there is a period of learning curve during which the rate of complications may be very high for both.[2] The present study was planned to compare the outcomes of the two operations, widely used in the surgical treatment of SUI, performed during the learning curve with regard to efficiency, complications and patient satisfaction.

MATERIAL AND METHOD

The study registered 70 patients who were diagnosed with stress urinary incontinence in the Obstetrics and Gynaecology Clinic of Fırat University Medical School in a period of 18 months starting on June the 1st 2006. After approval from Ethics Committee of the Fırat University Medical School was obtained, the study was planned prospectively. In the first 40 cases, all the patients were informed about both operations in the preoperative period and the choice of operation was made randomly by a different team in the operation room. After 20 TVT and 20 TOT operations, randomization was abandoned, due to the preference of the surgical team towards TOT. All the remaining cases were applied TOT and consequently, a total of 50 TOTs and 20 TVTs were conducted.

Cases who had diabetes, hypertension or another additional disease were not included in the study. Patients who described stress incontinence in the preoperative and postoperative controls were subjected to a stress test in order to objectively evaluate whether they actually had incontinence. When urge and stress incontinence could not be distinguished, an urodynamic examination was carried out. Cases who were shown not to have urge component by urodynamic examination were included in the study, while those with an urge component were not. The study evaluated operation duration, short-term success and complication rates of these two techniques performed within the learning period. In this context, preoperative and postoperative haematocrit levels, operation and anaesthesia durations, duration of catheterized hospital stays, as well as postoperative complaints and findings of the patients were recorded. Physical and pelvic examinations of the patients were carried out in the postoperative 1st and 3rd months in order to evaluate incision line wound infection, urinary infection, mesh erosion, *de novo* urge incontinence and patient satisfaction (IIQ-7 and UDI-6 survey forms).

The operations were started by a gynaecologist oncologist who participated as an assistant in about 5 live operations performed on patients by experienced incontinence surgeons in a course organized by the Turkish Association of Urogynaecology and Pelvic Reconstructive Surgery in the operation room of our hospital. All operations in the study were conducted by this surgeon and his team. Monofilament mesh (I-STOP) was used in the operations.

Statistical analysis: Data were presented as mean ± standard deviation (SD). Wilcoxon signed rank and Mann Whitney U tests were used in comparisons. Categorical data were expressed as numeric value and percentage. Values for which $p<0.05$ were accepted statistically significant.

RESULTS

Sociodemographic characteristics of the cases in TOT and TVT groups are presented in Table 1. Of the TOT cases, 4 had previous colporrhaphy anterior and 5 had a history of hysterectomy. None of the TVT group cases had a history of urogynaecological operation. An additional procedure was applied to 32 out of 50 TOT operation cases and 10 out of 20 TVT operation cases. All the operations were performed under general anaesthesia.

In addition to TOT operation, three cases were applied vaginal hysterectomy (VAH), five were applied vaginal hysterectomy + bilateral salpingoopherectomy (VAH-

TABLE 1. – Demographic characteristics of the patients.

	TOT (n:50)	TVT (n:20)
Age (years)	47.2±9.9	47.8±9.1
BMI (kg/m2)	29.5±4.1	29.3±2.2
Parity (n)	5.0±2.8	5.5±2.8
Incontinence duration (years)	6.3±5.3	5.7±3.7
Menopause	17 (%34)	6 (%30)
History of gynaecologic operation	9 (%18)	0 (%0)

BSO), four were applied total abdominal hysterectomy (TAH), eight were applied total abdominal hysterectomy + bilateral salpingoopherectomy (TAH-BSO), seven were applied colporrhaphy anterior, six were applied colporrhaphy posterior, four were applied perinoplasty, one was applied sacrocolpopexy, three were applied tubal ligation, one was applied hysteroscopic polyp extirpation, one was applied cervical conisation and one was applied Bartholin's cyst extirpation. In the TVT group, in addition to TVT, two cases were applied VAH, two were applied TAH-BSO, three were applied laparoscopy-assisted vaginal hysterectomy, one was applied colporrhaphy anterior, two were applied colporrhaphy posterior, one was applied perinoplasty, one was applied sacrospinous fixation, one was applied office hysteroscopy (H/S), and one was applied tubal ligation with laparoscopy (L/S). The mean duration of TOT operation was found 14.3±1.9 minutes and that of TVT was found 18.4±2.7 minutes. The difference between these two operation durations was statistically significant ($p<0.05$). The duration of hospital stay was 1.1±0.3 day in the group who had TOT only and 1.0±0 day in the group who had TVT only ($p>0.05$). Durations of hospital stay in the groups in which operations other than TOT and TVT were performed were 3.3±1.1 and 3.0±0.4 days respectively, and the difference between these values was insignificant ($p>0.05$). Duration of catheterized hospital stay was 12.2±4.2 hours in the TOT group and 12.5±3.8 hours in the TVT group ($p>0.05$). In the postoperative subjective evaluation, 80% of TOT patients said that they were satisfied with the operation, 10% said they felt better, relative to preoperative period, and 10% reported that they were not satisfied. Of the TVT cases, 85% expressed satisfaction, 5% said they felt better, compared to the preoperative period, and 10% said they were not satisfied.

Scores of IIQ-7 and UDI-6 surveys, which were responded by patients in the preoperative periods and postoperative 1st and 3rd months and which evaluated the patients' incontinence complaints and mental states in their social life, displayed statistically significant improvements (Appendix 1). TOT patients showed significant improvements in the 1st and 3rd postoperative months, compared to the preoperative period ($p<0.05$), but there was no difference between postoperative 1st and 3rd months ($p>0.05$). In the TVT group, however, significant improvements were found in the 1st and 3rd postoperative months, relative to the preoperative period, and between the postoperative 1st and 3rd months ($p<0.05$) (Table 2).

There was not any statistically significant difference between TOT and TVT groups in terms of urination dysfunction, leg pain and urinary tract infections ($p>0.05$) (Table 3). None of the TOT or TVT patients had intraoperative complications. A patient who had TOT operation developed mesh erosion in the 1st postoperative month. The patient was re-operated and the mesh was removed. The patient's incontinence complaint did not recur after the removal of the mesh. A patient who had TVT operation developed globe vesical at the postoperative 24th hour. The patient was recommended bladder training after catheterization, on the second day of which, the urination function was restored. It was found by urodynamics that one patient (5%) who had undergone TVT continued to experience stress incontinence. TOT operation was conducted in this patient and her symptoms resolved.

DISCUSSION

Our study demonstrated that TOT and TVT operations used in stress urinary incontinence were easily applied operations with a short learning period. No intraoperative or postoperative complications developed in any of the groups.

The major reason why intraoperative complications that are common particularly in the learning period were not encountered in our series can be explained by the fact that the surgical team was experienced in pelvic surgery and anatomy, although not in TOT and TVT. However, intraoperative wounds have been reported at a certain rate in the literature and require attention. Rafii et. al. reported bladder perforation in 9.6% of the cases who had TVT in their study. This risk was shown to increase in hysterectomy of pelvic reconstructive surgery, which was conducted concurrently.[3] In the same vein, Grise et. al. noted that bladder perforation occurred generally in situations where the operation was accompanied by hysterectomy or prolapsus repair, and recommended cystoscopy only in patients who had previous or simultaneous prolapsus operation, as bladder perforation is rare during TOT.[4] In our study, there was no complication even in the operations conducted simultaneously with TVT and TOT. In line with our routine procedures, operations like TVT and TOT are performed after pelvic surgery. We cannot claim that this approach is standard, but in this way, it is easy to show whether the bladder injury is associated with incontinence surgery or reconstructive surgery. The fact that additional surgical procedures were applied in about 32% of TOT cases and 50% of TVT cases indicates that a gynaecologist who operates on stress urinary incontinence cases needs to have substantial knowledge of pelvic reconstructive surgery as well.

Cystoscopy was not used in our cases in the present study or in other cases in our routine procedures. When the urine has a clear colour, it is an important sign that at least the bladder mucosa is intact. However, it should be noted that there may be some drawbacks at this point. One of these drawbacks is that in cases who do not have enough urinary discharge, the urine may be haematuric, but there may not be enough urine discharge from the catheter to see haema-

TABLE 2. – Evaluation of TOT and TVT treatment outcomes.

	TOT (n:50)				TVT (n:20)			
	Preop	Post-1	Post-3	p	Preop	Post-1	Post-3	p
IIQ-7	10.3±5.3	1.6±0.6*	0.9±0.4*	0.0001*	10.8±1.3	2.3±1.2*	1.4±0.9*	0.0001*
UDI-6	4.8±0.5	1.5±0.4*	0.9±0.3*	0.0001*	4.4±0.7	2.0±0.7**	0.9±0.4*	0.0001* 0.004**

TOT: Trans-obturator Suburethral Tape, TVT: Tension-free vaginal tape, preop: preoperative, post-1: postoperative day 1, post-3: postoperative day 3.

TABLE 3. – Early postoperative complications in TOT and TVT groups.

	TOT (n:50)	TVT (n:20)	P
Urinary disfunction	0.14±0.05	0.1±0.06	0.65
Leg pain	0.08±0.04	0.1±0.06	0.79
Urinary infection	0.08±0.04	0.15±0.08	0.38

turia. This may be the case in cases with haemorrhage or in hypotensive patients who were not provided with enough anaesthesia support. In order to eliminate this suspicion, it is sufficient to wait for a few minutes, until regular urinary discharge is observed. Another possibility is that haematuric appearance may not always indicate bladder laceration. The urine colour may change due to partial bladder mobilisation during additional surgical procedures. It can be stated in the light of this information that the risk of bladder injury may be minimized by taking the necessary care during surgery and having sound knowledge of anatomic landmarks. However, if the surgeon has suspicions that something may be wrong, cystoscopy should be performed. In this way, all the injuries that impair the mucosal integrity of the bladder may be revealed. Still, it should be born in mind that close submucosal passes that can lead to perforations in later periods, also known as late perforation, cannot be identified by cystoscopy.[5]

Another important complication is urination dysfunction. Rafii et. al. reported in their study that the concerned complication was observed in 9.1% of TVT patients.[6] In our study only one patient (5%) who had TVT developed globe vesical on the first postoperative day and recovered after a short catheterization and bladder training period. In cases where urination dysfunction is observed, mesh tension should be re-arranged postoperatively in the shortest time possible. It is recommended to re-open the old incision site and to pull the mesh about 5 mm downwards or to close the vaginal tissue individually. If this procedure is delayed, the mesh may merge with the tissue and cannot be loosened, and then it may be necessary to cut the mesh.[7] In our case who developed globe vesical, the catheter passed easily from the urethra, and consequently there was no problem and no need to loosen the mesh. However, easy passage of the catheter from the urethra should not be considered an objective indicator of the urethral narrowing caused by the mesh in the urethral compartment. It is also possible for the impaired urethral angle to prevent urinary discharge, despite the lack of any narrowing.[8] Similarly, it should be kept in mind that globe vesical may result from the general anaesthetics administered, postoperative pain and oedema. If the problem continues in spite of catheterization and bladder training, then complications associated with mesh application can be considered. Almost all meshes allow loosening at any time within the first 7 days of placement.

In TOT operations in particular, when vaginal wall dissection cannot be performed at a proper depth to reach the lower Halban fascia due to the differences in the depth of the vaginal sulcus and the strength of the vaginal tissue, there is increased risk of vaginal perioperative perforations and secondary erosion. In case of perioperative sulcus perforation, it can be recommended to open a new and deeper sulcus for the mesh and to have an extended period of sexual abstinence in the postoperative period.

The mean duration by which vaginal erosion manifests itself is 9 months.[9] The patients may be asymptomatic or they may present with symptoms such as vaginal discharge, pain during intercourse or at other times, or oedema in labia major.[9,10] Vaginal tape may be seen during vaginal examination or in some cases it may be coated with granuloma and may become invisible. When the tape is removed, most patients have become asymptomatic and remain in continent situation, without any recurrence of incontinence. Some authors recommend partial removal of the tape,[10] while others suggest total removal of non-woven tape.[9] Vaginal erosion in our patient occurred in the first postoperative month. The patient who felt uncomfortable during coital activity found in her self-examination a foreign body in the vicinity of the right vaginal sulcus. She had no other symptom like bleeding, discharge or vaginitis. Vaginal examination of the patient revealed that the mesh became visible in a 1 cm square area in the vicinity of the right vaginal sulcus. This area was partially amplified with an incision under local anaesthesia and that part of the mesh was completely removed. The remaining tissues were primarily sutured using an absorbable material. The patient did not develop any symptoms related to incontinence. Croak et. al. reported a recurrence rate ranging between 33% and 39% in patients in whom the TVT mesh was cut between postoperative weeks 2 and 69 due to urination dysfunction.[11,12] This condition may be associated with the area where the mesh was placed and cut. In our case, the removed part of the mesh is about 1 cm from the urethra and the fibrous tissue that developed adequately maintained continence, despite the partial removal of the mesh.

In a study where they performed TOT operations on 206 cases, Grise and colleagues reported 4 vaginal erosions, which occurred in months 2, 8, 13 and 25.4 In the present study, the cases have been followed up for 3 years and there has been no complications reported to us. Haemorrhage is a common condition during the operations, as pelvic tissues are rich in blood circulation and due to the injury to periurethral venous flexi. Although they worry the new beginners within the learning curve, life-threatening haemorrhages are very rare. In a study by Krauth and colleagues, haemorrhage was reported in 0.8% of TOT patients and was treated only by compression.13 TVT is no different than TOT in this respect, as although clinical hematoma was reported at a rate of 2.4%, operation was needed in only 0.2% of these patients.[5] It was also reported that a re-operation was required in 0.7% of TVT cases due to hematoma.[14] However, two mortalities were reported as a result of major vessel injuries associated with TVT, a retropubic hematoma requiring blood transfusion and catastrophic haemorrhages necessitating surgical intervention. [11,12,15-18]

It was noted that the major vascular structures in the retropubic area and anterior abdominal wall are located at the 0.9-6.7 cm lateral side of TVT needles.7 Therefore, the risk of a major haemorrhage is high in case the needle is oriented towards the lateral part due to worries about urinary bladder perforation or the movement of the patient under local anaesthesia.[7,19] In order to avoid vascular injuries, the surgeon should thrust the TVT needle in the direction of a line drawn from the mid labia major towards the shoulder on the same side and in the back of the pubis bone.5 Using the needle in this manner should significantly reduce the risk of haemorrhage. Intense bleedings observed particularly during incisions and opening of tunnels in both TOT and TVT operations show a marked decrease after the placement of mesh. Thus, in order to minimize unnecessary bleedings, it shall be useful to place the mesh immediately after the opening of the tunnel, without losing time, which shall be possible by preparing everything in advance.

In conclusion, the learning periods of surgical teams who have previous experience in pelvic anatomy and surgery can be overcome by a 0% intraoperative complication rate, on condition that surgical principles are closely followed. This result of ours has been supported by lack of any complications in about 100 cases in whom we performed TOT after the completion of this study.

The authors report no conflicts of interest.

REFERENCES

1. Novara G, Artibani W, Barber MD, Chapple CR, Costantini E, Ficarra V, Hilton P, Nilsson CG, Waltregny D. Updated systematic review and meta-analysis of the comparative data on colposuspensions, pubovaginal slings, and midurethral tapes in the surgical treatment of female stress urinary incontinence. Eur Urol. 2010; 58:218-38.
2. Groutz A, Gordon D, Wolman I, Jaffa AJ, David MP, Lessing JB. Tension-free vaginal tape for stress urinary incontinence: Is there a learning curve? Neurourol Urodyn. 2002;21:470-2.
3. Rafii A., Paoletti X., Haab F., Levardon M., Deval B. Tensionfree vaginal tape and associated procedures: a case control study. Eur Urol. 2004; 45:356-361.
4. Grise P., Droupy S., Saussine C., Ballanger P., Monneins F., Hermieu J.F., Serment G., Costa P. Transobturator tape sling for female stress incontinence with polypropylene tape and outside-in procedure: prospective study with 1 year of minimal follow-up and review of transobturator tape sling. Urology. 2006; 68:759-63.
5. Kuuva N., Nilsson C.G. A nationwide analysis of complications associated with tension-free vaginal tape (TVT) procedure. Acta Obstet Gynecol Scand. 2002; 81:72-77.
6. Costa P., Grise P., Droupy S., Monneins F., Assenmach. er C., Ballanger P., Hermieu J.F., Delmas V., Boccon-Gibod L., Ortuno C. Surgical treatment of female stress urinary incontinence with a transobturator-tape (T.O.T.) Uratape: short term results of a prospective multicentric study. Eur Urol. 2004; 46:102-6.
7. Ozel B., Minaglia S., Hurtado E., Klutke C.G., Klutke J.J. Treatment of voiding dysfunction after transobturator tape procedure. Urology. 2004;64:1030 8-Petros P.E., Ulmsten U. An integral theory of female urinary incontinence: experimental and clinical considerations. Acta Obstet Gynecol Scand Suppl. 1990; 153:7-31.
9. Domingo S., Alama P., Ruiz N. Diagnosis, management and prognosis of vaginal erosion after transobturator suburethral tape procedure using a nonwoven thermally bonded polypropylene mesh. J Urol. 2005; 173:1627-1630.
10. Mellier G., Benayed B., Bretones S., Pasquier J.C. Suburetral tape via the obturator route: is the TOT a simplification of the TVT?. Int Urogynecol J Pelvic Floor Dysfunct. 2004; 15:227-32.
11. Croak A.J., Schulte V., Peron S. (et al). Transvaginal tape lysis for urinary obstruction after tension-free vaginal tape placement. J Urol. 2003; 169:2238-2241.
12. Rardin C.,Rosenblatt P.L., Kohli N. Release of tensionfree vaginal tape for the treatment of voiding dysfunction. Am J Obstet Gynecol. 2002; 100:898-902.
13. Krauth J.S., Rasoamiaramanana H., Bartela H. (et al). Suburethral tape treatment of female urinary incontinence—morbidity assessement of the trans-obturator route and a new tape (I-STOP): a multi-centre experiment involving 602 cases. Eur Urol. 2005; 47:102-107.
14. Bump R.C., Mattiasson A., Bo K. The standardization of terminology of female pelvic organ prolapse and pelvic flor dysfunction. Am J Gynecol. 1996; 175:10-17.
15. Vierhout M.E. Severe hemorrhage complicating tensionfree vaginal tape (TVT): A case report. Int Urogynecol J. 2001; 12:139-140.
16. Zilbert A.W., Farrell S.A. External iliac artery laceration during tension-free vaginal tape procedure. Int Urogynecol J. 2001; 12:141-143.
17. Walters M.D., Tulikangas P.K., LaSala C., Muir T.M. Vascular injury during tension-free vaginal tape procedure for stress urinary incontinence: A case report. Obstet Gynecol. 2001; 98:957-959.
18. Fischer A., Fink T., Zachmann S., Eickenbusch U. Comparison of retropubic and outside-in transobturator sling systems for the cure of female genuine stress urinary incontinence. Eur Urol. 2005; 48:799-804.
19. Karram M.M., Segal J.L., Vassallo B.J., Kleeman S.D. Complications and Untoward Effects of the Tension-Free Vaginal Tape Procedure. Obstet Gynecol 2003; 101: 929-932.

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Review

STARR: indications, results and safety. Review of literature

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Abstract: Treatment of obstructed defecation (OD) is extremely challenging. Patients with symptoms of OD may demonstrate certain anatomic abnormalities on defecography, such as rectal intussusception, rectal prolapse, and recto- or enterocele. Internal rectal prolapse (rectal intussusception) and rectocele are frequent clinical findings in patients suffering from refractory constipation. However, there is still no clear evidence whether the STARR procedure (stapled transanal rectal resection) provides a safe and effective surgical option for symptom resolution in ODS patients In this paper we reviewed the literature to summarize the surgical outcomes and postoperative complications following STARR procedure considering the largest multicentric studies published in literature.

Key words: STARR; Obstructed defecation; Rectal prolapse; Intussusception; Literature review.

INTRODUCTION

Stapled transanal rectal resection (STARR) is indicated for obstructed defecation syndrome (ODS), a complex and multifactorial condition. ODS is more common in women, particularly multiparous women, than in men.[1-3]

ODS is characterised by the urge to defecate but an impaired ability to expel the faecal bolus. Symptoms include unsuccessful faecal evacuation attempts, excessive straining, pain, bleeding after defecation, and a sense of incomplete faecal evacuation. Rectocele (herniation of the rectum into the vagina), internal rectal mucosal prolapse and rectal intussusception may also be associated with ODS. Genital prolapse, enterocele and non-relaxing puborectalis may also coexist.[4]

It has been estimated that approximately 20% of adult female population suffered from the syndrome. The etiology of ODS is likely to be multifactorial, resulting from the interaction of functional and anatomic factors that influence the recto-anal evacuatory mechanism.

Conservative treatment such as diet, biofeedback or pelvic floor retraining improves symptoms in the majority of patients with ODS. Surgery may be considered in patients for whom conservative treatments have failed and where there is an underlying structural abnormality such as rectocele.[1-4]

To date, a variety of surgical techniques including transvaginal, transperineal, transanal, and combined abdominal and vaginal approaches have been described for the treatment of ODS. However, there is no method achieving overall superiority because of different patterns of complications and high rate of recurrence.[1]

Based on the stapled hemorrhoidopexy procedure, it has been proposed an alternative technique for patients with ODS caused by rectocele (RE) and rectal intussusception (RI) called stapled transanal rectal resection (STARR). The novel technique is carried out sequentially using double circular stapler devices (PPH01, Ethicon Endo-Surgery), anteriorly and posteriorly, to restore normal rectal anatomy by strengthening rectovaginal septum and resecting redundant rectum. STARR has been implemented rapidly and described as an effective cure for RE, RI, prolapsed hemorrhoids and even solitary rectal ulcer.3 In addition, observations from several case series and multicenter trials have demonstrated a clinical benefit of the procedure in short-term follow-up.[5] Nevertheless, some unique and troublesome complications were also documented by a few case reports.[4]

SURGICAL TECHNIQUE

The STARR procedure uses two circular staplers (PPH01, Ethicon Endo-Surgery) to produce a circumferential transanal full-thickness resection of the lower rectum.1,5 The combination of the two stapled resections aims to correct the structural abnormalities associated with obstructed defecation syndrome (ODS), i.e. rectal intussusception, rectocele and mucosal prolapse

A circular anal dilator is introduced into the anal canal and secured with skin sutures. Up to four sutures are placed in the anterior rectal wall at intervals above the ano-rectal junction in a semicircular manner. A retractor is then positioned to protect the posterior rectal wall. The first circular stapler is introduced into the rectum and the open head positioned above the level of the most proximal suture. The stapler is closed and fired to perform the anterior rectal resection.

The procedure is repeated for the posterior rectal resection. Two or more semicircular sutures are placed posteriorly above the anorectal junction. The anterior rectum is protected with a retractor. The second circular stapler is introduced into the rectum with the open head positioned above the level of the most proximal suture. The stapler is closed and fired to perform the posterior rectal resection.[1-5]

SURGICAL OUTCOME

Enthusiastic results have been reported after STARR in the first sample limited short-term studies with good to excellent outcomes in up to 90% of patients.[5]

Subsequently different multicenter trials either have been published in order to assess efficacy and safety of STARR procedure.[5-13]

The European Stapled Transanal Rectal Resection Registry was initiated in January 2006. Data were collected prospectively on effectiveness (symptom severity and obstructed defecation scores), quality of life, incontinence, and safety profile at baseline, 6 weeks, 6 months, and 12 months. At the review performed in May 2008, a total of 2,838 patients were entered into the registry, of whom 2,224 had reached 12 months of follow-up. Mean age was 54.7 years. A total of 2,363 patients (83.3%) were female. A significant improvement was seen in obstructive defecation and symptom severity scores and quality of life between baseline and 12 months (obstructed defecation score: 15.8 vs. 5.8, respectively, $P < 0.001$; symptom severity score: 15.1 vs. 3.6, respectively, $P < 0.001$). Complications

were reported in 36.0% and included defecatory urgency (20.0%), bleeding (5.0%), septic events (4.4%), staple line complications (3.5%), and incontinence (1.8%). One case of rectal necrosis and one case of rectovaginal fistula were reported.[6]

The German STARR registry was designed as an interventional, prospective, multicenter audit. Primary outcomes included safety (morbidity and adverse events), effectiveness (ODS, symptom severity, and incontinence scores), and quality of life (PAC-QoL and EQ-5D) documented at baseline and at 6 and 12 months. Data of 379 patients (78% females, mean age 57.8 years) were included. Mean operative time was 40 min, mean hospitalization was 5.5 days. A total of 103 complications and adverse events were reported in 80 patients (21.1%) including staple line complications (minor bleeding, infection, or partial dehiscence; 7.1%), major bleeding (2.9%), and postsurgical stenosis (2.1%). Comparisons of ODS and symptom severity scores (SSS) demonstrated a significant reduction in ODS score between baseline (mean 11.14) and 6 months (mean 6.43), which was maintained at 12 months (mean 6.45), and SSS at preoperative and at 6- and 12-month follow-up (13.02 vs. 7.34 vs. 6.59; paired t test, $p < 0.001$). Significant reduction in ODS symptoms was matched by an improvement in quality of life as judged by symptom-specific PAC-QoL and generic ED-5Q (utility and visual analog scale) scores and was not associated with an impairment of incontinence score following STARR ($p > 0.05$). However, 11 patients (2.9%) showed de novo incontinence, and new-onset symptoms of fecal urgency were observed in 25.3% of patients.[7]

The STARR Italian Registry (SIR) collected data regarding preoperative assessment of patient and surgical outcome at 6 and 12 months using dedicated tools such as the Obstructed Defecation Syndrome Score (ODS-S), the Severity Symptom Score (SSS), and the Continence Grading Scale (CGS). Data on the quality of life were collected by Patient Assessment of Constipation Quality of Life (PAC-QoL) and the Euro Quality of Life-5 Domains Visual Analogue Scale (EQ-5D VAS). The SIR collected data on 2171 patients (1653 females, 76.1%; mean age 56.2 years; range 20- 96 years). A significant improvement ($P < .0001$) was seen between preoperative and 12-month follow-up in all scores: ODS-S (16.7 vs 5.0), SSS (15.6 vs 2.6), CGS (2.0 vs 0.7), PAC-QoL (51.0 vs 22.1), and EQ-5D VAS (57.5 vs 85.7). Complications included defecatory urgency (4.5% at 12 months), bleeding (3.6%), perineal sepsis (3.4%), and one case of rectovaginal fistula (0.05%).[8]

Recently in a prospective multicenter Spanish trial Arroyo et al9 reported data on 104 patients diagnosed with ODS and treated with STARR. Mean operating time was 46.7 min. Haemorrhage at the staple line occurred in 55 patients (52.9 per cent). Three patients required surgical revision in the first 48 h owing to persistent bleeding. The median postoperative pain score was 2.4 on a scale from 1 to 10. Mean hospital stay was 2.2 days. The mean constipation score improved from 13.5 before surgery to 5.1 at 1-year follow-up ($P = 0.006$). Twenty-three patients reported faecal incontinence at 4 weeks after surgery, but only nine still had minor residual incontinence by 1 year. At a median follow-up of 26 (range 12-72) months, ODS had recurred or persisted radiologically and/or clinically in 11 patients.

Interestingly the ODS II study group randomized 119 women patients who suffered from obstructed defecation with associated rectocele and rectal intussusception to stapled transanal rectal resection or biofeedback training. Fourteen percent (8/59) stapled transanal rectal resection and 50 percent (30/60) biofeedback training patients withdrew early. Eight (15%) patients treated with stapled transanal rectal resection and 1 (2%) biofeedback patient experienced adverse events. One serious adverse event (bleeding) occurred after stapled transanal rectal resection. Scores of obstructed defecation improved significantly in both groups as did quality of life (both $P < 0.0001$). Successful treatment was observed in 44 (81.5%) stapled transanal rectal resection vs. 13 (33.3%) evaluable biofeedback training patients ($P < 0.0001$). Functional benefit was observed early and remained stable during the study. The authors concluded that stapled transanal rectal resection was more effective than biofeedback training for the resolution of obstructed defecation symptoms, and improved quality of life, with minimal risk of impaired continence.[10]

SAFETY

Previous studies have shown a clinical benefit of the STARR procedure for ODS However, limited effect and some serious complications were also described.[4]

Some authors reported persistence of symptoms in over 40% of patients and lack of improvement in over 30% of patients. Besides, reintervention may be needed in over 10% either for postoperative complications or recurrence of the disease.[14,15]

The risk of adverse events and poor outcome following STARR may be increased by concomitant pelviperineal impairments such as anismus, enterocele and sigmoidocele that are contraindications to the procedure.[14]

Postoperative bleeding occurred in the above mentioned trials in 2-5% of patients; besides Arroyo reported bleeding at the staple line in over 50% of patients. A manual suture to reinforce the staple line minimizes the risk of bleeding after STARR. Delayed bleeding may be caused by a granuloma which may be surgically removed.[15,16]

Gagliardi5 reported postoperative pelvic pain in about 10% of patients; Arroyo reported an average of 2.1 postoperative VAS score.9 The pathogenesis of post-STARR proctalgia may be due to retained staples, reduced rectal compliance secondary to full-thickness resection and the double staple line and finally entrapment of innervated striated muscle fibers. Excision of the suture scar, pelvic floor rehabilitation, neurosacral stimulation have been proven to be effective in some selective cases.[15-17]

Accumulating evidences have shown that defecatory urgency was the most common complaint in the immediate and intermediate recovery periods after STARR reported in over 20% of patients.[19] In a recent randomized controlled trial, Boccasanta et al reported that incidence of fecal urgency was 34.0% in the STARR group.[19] Although the exact etiopathogenesis of defecatory urgency is unclear, it may reflect the inflammatory response related to the staple line, presence of irritable rectum, and reduced rectal capacity or compliance. Urgency and low rectal compliance after STARR may be successfully treated with pelvic floor rehabilitation.[15,19-21]

De novo fecal incontinence has been reported in up to 20% of patients in the above mentioned multicentric trials. Fecal incontinence may be due to a device-related fragmentation of the internal sphincter, a complication already reported after PPH.[15,19-21] Moreover, fecal incontinence may be neurogenic, due either to vaginal multiparity or chronic straining leading to pudendal neuropathy or to previous hysterectomy, with damage of the pericervical plexus involving anorectal innervation.[22,23]

Transanal electrostimulation and sacral neuromodulation may help in treating such conditions. Bulking agents, and levatorplasty have also been successfully used.24-27

Exceptional complications such us rectovaginal fistula, total rectal obliteration, rectal wall hematoma, perforation with fecal peritonitis, retroperitoneal sepsis potentially life

threatening, requiring surgery and often a diverting stoma have also been reported in literature.[28-33]

INNOVATIONS AND BREAKTHROUGHS

STARR procedure with PPH 01 has limitations in the amount of rectal wall that can be resected; furthermore, the use of a circular stapler also requires retraction of the opposite rectal wall with a retractor. In addition, resection is performed 'blind' after trans-anal insertion of the stapler. A new device has been designed to overcome these difficulties. The Contour Transtar stapler (Ethicon Endo-Surgery; Cincinnati) is designed to allow tailored modulation of the amount of rectal wall to be resected and to improve open visualization of the procedure .the Contour Transtar stapler™ (Ethicon Endo-Surgery, Inc.).

Recently, Jayne et al33 in a prospective multicentric trial compared 150 constipated patients treated with either PPH-STARR (n = 68) or Contour Transtar (n = 82).The mean size of the resected specimen was 27 cm2 in the PPH-STARR group and 46 cm2 in the CT group ($P < 0.001$). Morbidity was 7.3% (n = 5) in the PPH-STARR group and 7.5% (n = 6) in the CT group. Neither septic complications nor surgical re-interventions were observed. The most common complication was minor postoperative bleeding in 2 cases in both groups. Postoperative pain was more frequent after contour TRASTARR (3.5%versus 1.4%).

Constipation Scores (CCS) were similar in the 2 groups (15.50 in the PPH-STARR group and 15.70 in the CT group preoperatively and decreased significantly to 8.25 and 8.01 at 12-months after surgery.[33]

Meurette suggested that it would be wise to select the STARR procedure for a predominant ''isolated'' RE and the Transtar procedure for a high grade RI. Therefore, further research into this area is required to optimize patient selection, and the difference in function and efficacy between STARR and TRANSTARR remains to be observed.

REFERENCES

1. Corman ML, Carriero A, Hager T et al. Consensus conference on the stapled transanal rectal resection (STARR) for disorders defaecation. *Colorectal Dis*. 2006; 8:98-101.
2. Felt-Bersma RJ, Cuesta MA. Rectal prolapse, rectal intussusception, rectocele and solitary ulcer syndrome. *Gastroenterol Clin North Am*. 2001;30:199-222.
3. Kim DS et al. Complete rectal prolapse: Evolution of management and results. *Dis Colon Rectum* 1999; 42:460–466.
4. Pescatori M, Milito G, Fiorino M, Cadeddu F. Complications and reinterventions after surgery for obstructed defecation. *Int J Colorectal Dis*. 2009; 24:951-959.
5. Gagliardi G, Pescatori M, Altomare DF, Binda GA, Bottini C, Dodi G, Filingeri V, Milito G, Rinaldi M, Romano G, Spazzafumo L, Trompetto M. Italian Society of Colo-Rectal Surgery (SICCR) Results, outcome predictors, and complications after stapled transanal rectal resection for obstructed defecation. *Dis Colon Rectum*. 2008; 51:186-95.
6. Stuto A, Schwander O, Jayne D Assessing safety of the STARR procedure for ODS: preliminary results of the European STARR Registry. *Dis Colon Rectum*. 2007; 50:724.
7. Schwandner O, Fürst A. German STARR Registry Study Group. Assessing the safety, effectiveness, and quality of life after the STARR procedure for obstructed defecation: results of the German STARR registry. *Langenbecks Arch Surg*. 2010; 395:505-13
8. Stuto A, Renzi A, Carriero A, Gabrielli F, Gianfreda V, Villani RD, Pietrantoni C, Seria G, Capomagi A, Talento P. Stapled Trans-Anal Rectal Resection (STARR) in the Surgical Treatment of the Obstructed Defecation Syndrome: Results of STARR Italian Registry. *Dis Colon Rectum*. 2009; 52:1205-12; discussion 1212-4.
9. Arroyo A, Perez-Vicente F, Serrano P et al. Evaluation of stapled transanal rectal resection technique with two staplers in the treatment of obstructive defaecation syndrome. *J Am Coll Surg*. 2007;204:56-63
10. Lehur PA, Stuto A, Fantoli M, Villani RD, Queralto M, Lazorthes F, Hershman M, Carriero A, Pigot F, Meurette G, Narisetty P, Villet R; ODS II Study Group. Outcomes of stapled transanal rectal resection vs. biofeedback for the treatment of outlet obstruction associated with rectal intussusception and rectocele: a multicenter, randomized, controlled trial. *Dis Colon Rectum*. 2008; 51:1611-8.
11. Boccasanta P, Venturi M, Roviaro G. Stapled transanal rectal resection versus stapled anopexy in the cure of hemorrhoids associated with rectal prolapse. A randomized controlled trial. *Int J Colorectal Dis*. 2007; 22:245-251.
12. Pechlivanides G, Tsiaoussis J, Athanasakis E et al. Stapled transanal rectal resection (STARR) to reverse the anatomic disorders of pelvic floor dyssynergia. *World J Surg*. 2007; 31:1329-1335.
13. Goede AC, Glancy D, Carter H, Mills A, Mabey K, Dixon AR. Medium-term results of stapled transanal rectal resection (STARR) for obstructed defecation and symptomatic rectal-anal intussusception. *Colorectal Dis*. 2011;13:1052-7.
14. Gagliardi G, Pescatori M, Altomare DF et al. Factors predicting outcome after stapled transanal rectal resection (STARR) procedure for obstructed defecation. *Dis Colon Rectum [epub-ahead of print] PMID*. 2007; 18157718.
15. Pescatori M, Gagliardi G. Postoperative complications after procedure for prolapsed hemorrhoids (PPH) and stapled transanal rectal resection (STARR) procedures. *Tech Coloproctol*. 2008; 12:7-19.
16. Dodi G, Pietroletti R, Milito G, Binda GA, Pescatori M. Bleeding, incontinence, pain and constipation after STARR transanal double stapling rectotomy for obstructed defecation. *Tech Coloproctol*. 2003;7:148-153.
17. De Nardi P, Bottini C, Faticanti Scucchi L, Palazzi A, Pescatori M. Proctalgia in a patient with staples retained in the puborectalis muscle after STARR operation. *Tech Coloproctol*. 2007; 11:353-356.
18. Dudding TC, Vaizey CJ, Jarret ME, Cohen RG, Kamm MA. Permanent sacral nerve stimulation for treatment of functional anorectal pain: a report of a case. *Dis Colon Rectum*. 2007; 50:1275-1278.
19. Boccasanta P, Venturi M, Roviaro G. What is the benefit of a new stapler device in the surgical treatment of obstructed defecation? Three-year outcomes from a randomized controlled trial. *Dis Colon Rectum*. 2011; 54:77-84.
20. Pucciani F, Ringressi RM, Giani J. Persistent dyschezia after double stapled transanal rectal resection for outlet obstruction: four case reports. *Pelviperineology*. 2007; 26:132-135.
21. Ho YH, Tsang C, Tang CL, Nyam D, Eu KW, Seow-Choen F. Anal sphincter injuries from stapling instrumentum introduced transanally: randomized controlled study with endoanal ultrasound and anorectal manometry. *Dis Colon Rectum*. 2000; 43:169-173.
22. Forsgren C, Zetterstrom J, Lopez A, Nordnstam J, Anzen B,Altman D. Effects of hysterectomy on bowel function: a three-year, prospective cohort study. *Dis Colon Rectum*. 2007; 50:1139-1145.
23. Beer-Gabel M, Frudinger A, Zbar AP. Ultrasound in coloproctologic practice. In: Wexner SD, Zbar AP, Pescatori M (eds). Complex anorectal disorders. *Springer, Berlin Heidelberg New York*. 2005; 747-760.
24. Ripetti V. Efficacy of sacral nerve stimulation for fecal incontinence: results of a multicenter double-blind crossover study. *Tech Coloproctol*. 2006; 10:159-160.
25. Boffi F. Rectal stricture, pocket and fistula after STARR procedure: lay-open, curettage and rectal advancement flap. *Tech Coloproctol*. 2007; 11:195.
26. Spyrou M, De Nardi P Fecal incontinence after stapled transanal rectotomy managed with Durasphere injection. *Tech Coloproctol*. 2005; 9:87.
27. Baeten C, Bartolo DC, Lehur PA et al. Consensus conference on fecal incontinence. *Tech Coloproctol*. 2007 ; 11:128-134.
28. Pescatori M, Dodi G, Salafia C, Zbar AP Rectovaginal fistula after double-stapled transanal rectotomy (STARR) for obstructed defaecation. *Int J Colorectal Dis*. 2005; 20:83-85.
29. Gagliardi G, Pescatori M. Clinical and functional results after tailored surgery for rectovaginal fistula. *Pelviperineology*. 2007; 26:78-81.

30. Bassi R, Rademacher J, Savoia A . Rectovaginal fistula after STARR procedure complicated by haematoma of the posterior vaginal wall: report of a case. *Tech Coloproctol*. 2006; 10: 361-363.
31. Stolfi VM, Micossi C, Sileri P, Venza M, Gaspari A. Retroperitoneal sepsis with mediastinic and subcutaneous emphysema complicating stapled transanal rectal resection. *Tech Coloproctol*. 2008.
32. Boffi F. Rectal stricture, pocket and fistula after STARR procedure: lay-open, curettage and rectal advancement flap. *Tech Coloproctol*. 2007; 11:195.
33. Isbert C, Reibetanz J, Jayne DG, Kim M, Germer CT, Boenicke L. Comparative study of Contour Transtar and STARR procedure for the treatment of obstructed defecation syndrome (ODS)--feasibility, morbidity and early functional results. *Colorectal Dis*. 2010 Sep;12: 901-8.
34. Joyce EA, Kavanagh DO, O'Connell PR, Hyland JM. Massive intra-abdominal haemorrhage following stapled haemorrhoidopexy. *Int J Colorectal Dis*. 2011 Jul 6. [Epub ahead of print].

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Case report

Managing an incidental abscess after secondary insertion of transobturator tape

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Abstract: During the last 5 years the transobturator tape (TOT) procedure has become a frequent surgical technique for the treatment of SUI instead of retro pubic vaginal tape (TVT). The cure rates are almost identical in a range of up to 90%. Nevertheless, these very good results are associated with rare complications such as fistulas and abscesses. Due to the low complication rate it is always a challenge to treat such complications since general guidelines are missing.

Key words: TOT; SUI; Abscess; Tape.

CASE REPORT

We report on a rare complication of adductor muscle abscess following a second insertion of a suburethral transobturator tape for SUI.

Our typical procedure in patients with SUI-recurrence due to a loose or slipping sling or with bladder emptying problems due to sling obstruction is as follows: we cut or, if possible, remove the middle part of the tape in a first operation. If necessary at least three months later we insert a new tape in a second operation.

In this case we changed our routine due to the strict order of the patient. She, a 53-year-old woman presented a secondary SUI after TOT and infracoccygeal sacropexy (Posterior IVS "PIVS") for enterocoele 4 years ago. Vaginal ultrasound showed that the tape "slipped" to bladder trigonum without any closing function of the urethra. No erosions or inflammatory signs were noticed. We explained our above mentioned typical procedure to the patient. But she decided to have the new TOT sling at the same time. We removed the middle part of the old tape and inserted a new one. There was no intraoperative complication, the patient was continent and discharged 5 days after the operation.

She came back 8 days p.o. with acute pain in the medial aspect of her left thigh. Blood values showed increased CRP of 333.7 mg/l and leukocytes of 15.2 /ml. Transvaginal examination and ultrasound showed a correct position of the tape, without any signs for haematoma, abscess or residual urine.

Doppler ultrasound excluded thrombosis, but showed a fluid structure in the left adductor space, in a CT-scan this was interpreted as an old haematoma (Figure 1).

After excluding other infection foci by thorax-X-ray, urine and blood culture, intravenous antibiotic treatment was started with cephalosporin 3rd generation and metronidazole. Because fever continued up to 39 degree Celsius, CRP was still 272 mg/l and the patient suffered from pain in the left upper leg, a second CT-scan was performed on the 12th day p.o.. At this time the CT showed a suspicion of abscess in the left adductor space (Figure 2 and Figure 3).

Our surgeon recommended a CT-guided drainage by interventional radiology to flush out the pus with NaCl instead of open surgery (Figure 4). Microbiology of the pus resulted in Staphilococcus constellatus. We performed this treatment until the 21st day p.o.. We abstained from removing the new tape.

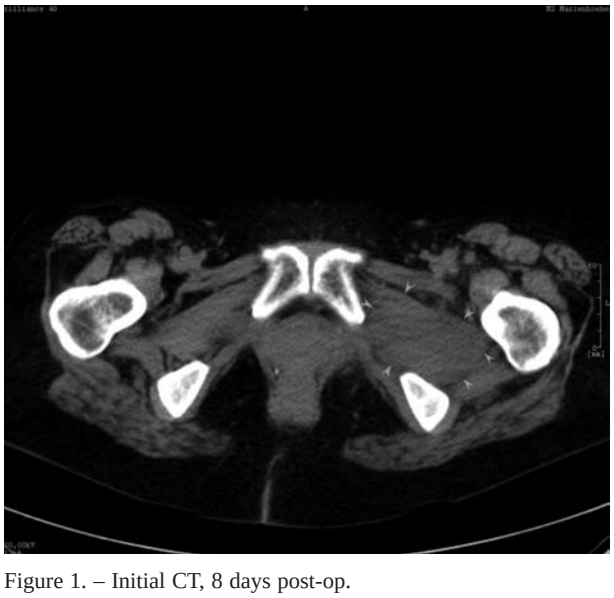

Figure 1. – Initial CT, 8 days post-op.

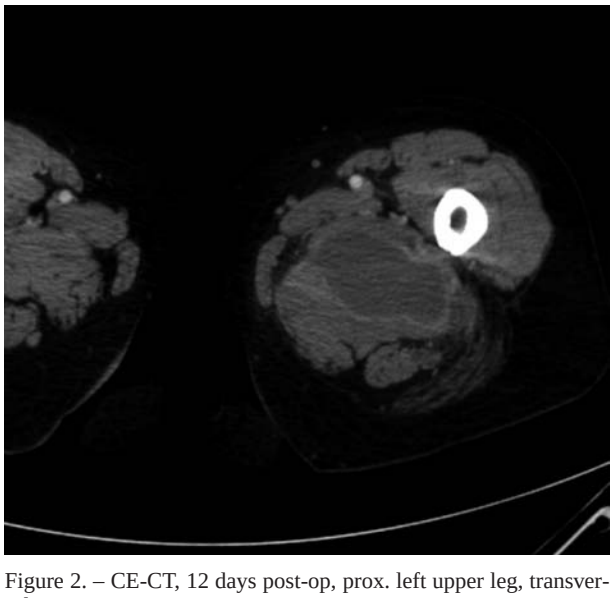

Figure 2. – CE-CT, 12 days post-op, prox. left upper leg, transversal.

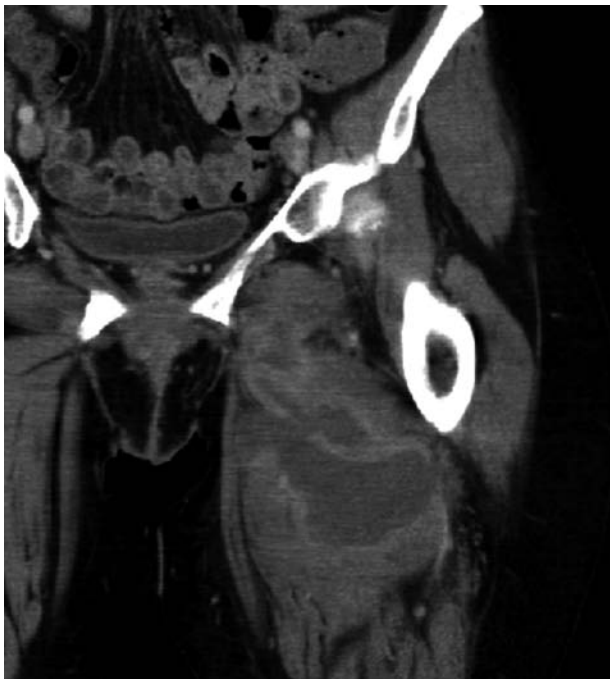

Figure 3. – CE-CT, 12 days post-op, prox. left upper leg and pelvis, coronal.

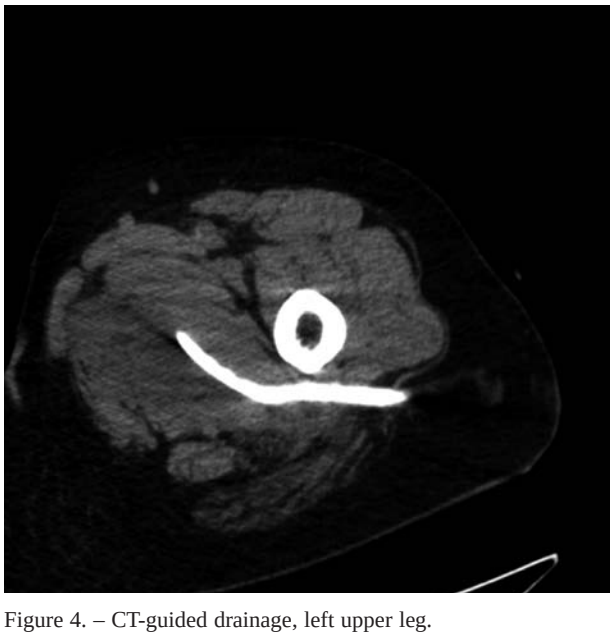

Figure 4. – CT-guided drainage, left upper leg.

After this local therapy the CE-CT-scan showed no residual abscess (Figure 5). The CRP was normal. Therefore we removed the drain and discharged the patient.

The follow-up examination 3 months later showed no residual abscess, the patient was pain-free, continent and satisfied with the result. In this case removing of the tape was not necessary.

DISCUSSION

Up to now there are no clear recommendations how to manage an abscess after TOT. In most cases the surgeon decides to remove the tape immediately and, if possible, completely in combination with debridement of the area. This procedure seems to be unavoidable if vaginal erosions exist.

In our case, the absence of erosion combined with an obturator abscess encouraged us to a local more conservative approach. Flushing out the adductor area with CT-guided drainage cured the patient without removing the tape. This shows that not in all situations a macroporous monofilament polypropylene tape or mesh has to be removed. But nevertheless it is not clear whether a remaining tape can induce bacterial infection later on.

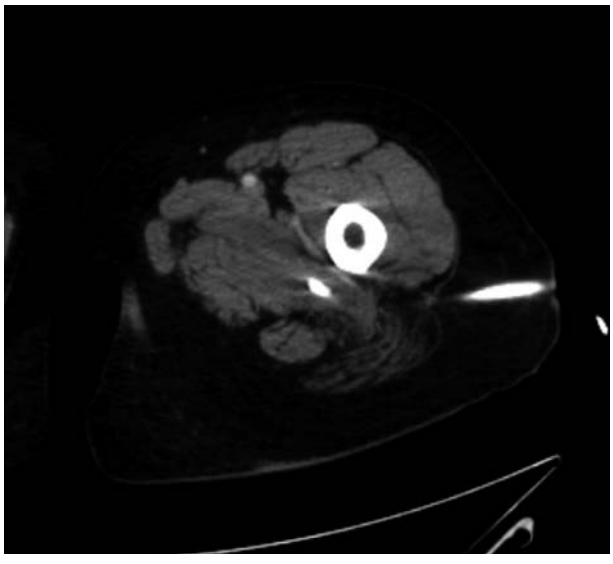

Figure 5. – CE-CT, after 8 days with drainage.

CONCLUSION

When a suburethral tape has to be removed and a new sling is necessary, the safest way to prevent infections is to insert the new sling after an interval of at least three month. Following this rule we never have seen an infection in the past. As shown above in case of bacterial complications it is not always necessary to remove the tape.

The first diagnostic steps that are required are still clinical examination and findings, inflammatory blood values and ultrasound. In addition a contrast enhanced CT (CE-CT) can be very effective in detecting an abscess by showing the contrast-enhancing abscess membrane. Furthermore MRI and CE-MRI are suitable for diagnostics of soft- and connective tissue disorders. But they are also much more expensive methods which are not always available everywhere. Therefore they should be used secondarily in such cases that remain unclear after ultrasound and CE-CT.

Based on the diagnostic findings the surgeon has to decide individually about open surgery or an attempt with a guided drainage. Minimal invasive management seems to be safe enough, if the patient stays in hospital.

REFERENCES

1. Ulmsten U, Petros P. Intravaginal slingplasty (IVS) : an ambulatory surgical procedure for treatment of female urinary incontinence. Scand J Urol Nephrol 1995; 29:75-82.
2. Deval B, Ferchaux J, Berry R, Gambino S, Ciofu C, Rafii A, Haab F. Objective and subjective cure rates after trans-obturator tape (OBTAPE) treatment of female urinary incontinence. Eur Urol 2006; 49:373-377.
3. Latthe PM, Foon R, Toozs-Hobson P. Transobturator and retropubic tape procedures in stress urinary incontinence: a systematic review and meta-analysis of effectiveness and complications. Bjog 2007; 114:522-531.
4. Hinterholzer S, Wunderlich M, Riss P, Geiss I. Management of Vaginal Tape Erosion and Thigh Abscess after Transvaginal Obturator Tape (TVT-O). Geburtsh Frauenheilk 2007, 67:66-69.
5. Marsh F, Rogerson L. Groin abscess secondary to trans obturator tape erosion: case report and literature review. Neurourol Urodyn. 2007; 26:543-6.

6. Tamussino K, Hanzal E, Koelle D, Tammaa A, Preyer O. Transobturatorische Baender bei Stressinkontinenz: Ergebnisse des Oesterreichischen Registers. Geburtsh Frauenheilk 2007; 67.
7. DeSouza R, Shapiro A, Westney OL. Adductor brevis myositis following transobturator tape procedure: a case report and review of the literature. Int Urogynecol J Pelvic Floor Dysfunct. 2007 Jul; 18:817-20.

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Book review

As announced in the Editorial by Bruce Farnsworth (Pelviperineology 2011; 30:5) this is the fourth of a series of articles highlighting the different sections of the book "Pelvic Floor Disorders, Imaging and Multidisciplinary Approach to Management" edited by G.A. Santoro, P. Wieczorek, C. Bartram, Springer Ed, 2010.

Urinary incontinence and voiding dysfunction

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The *fourth section* of the book "Pelvic floor disorders-Imaging and Multidisciplinary Approach to Management" is entitled "Urinary Incontinence and Voiding Dysfunction" and consists of nine chapters divided into two subsections describing diagnostic methods and management of these disturbances.

In the first chapter "Ultrasonography" A. P. Wieczorek, M. M. Woźniak and A. Stankiewicz review basic information about techniques, equipment advantages, limitations, clinical usefulness, and the literature concerning ultrasound assessment in the diagnostics and monitoring of treatment of urinary incontinence (UI) and voiding dysfunctions (VD) with reference to two-dimensional (2D) and three-dimensional (3D) transperineal ultrasound (TPUS), as well as 2D and 3D endovaginal ultrasound (EVUS). Transperineal ultrasound (TPUS, Figure 1a-b) is recognized nowadays as a gold standard technique in the diagnosis of UI and VD and is a very useful method, which allows overall assessment of all anatomical structures (bladder, urethra, vaginal walls, anal canal and rectum) located between the posterior surface of the symphysis pubis and the ventral part of the sacral bone. However, EVUS offers significant amount of additional information providing detailed assessment of the morphology, vascularity, and functionality of the urethral complex and appears to play a relevant role in the management of these pathological conditions. The authors highlight the special role of more sophisticated modalities such as novel 3D, 4D high-frequency, endoluminal ultrasonography. They recommend high-frequency techniques as the ones, which have the biggest impact on the diagnostics and most probably in near future will become gold standard examinations in the diagnostics and monitoring of treatment of urinary incontinence and voiding dysfunctions.

The second chapter "Urodynamics" by E. Ostardo, G. Tuccitto, F. Beniamin and L. Maccatrozzo provides information on urodynamic tests measure parameters related to the storage and voiding functions of the lower urinary tract. Investigations encompass a variety of tests, including uroflowmetry, cystometry, pressure-flow studies, urethral sphincter electromyography, video-urodynamics, urethral pressure profilometry and Valsalva leak point pressure test (Figure 2). The chapter describes in details each of the above mentioned methods, their indications, methodology, clinical usefulness and interpretation of the obtained results. The usefulness of urodynamics remains controversial, however it can provide a pathophysiological explanation of urinary dysfunction, guiding clinical management. If there are persistent criticisms of urodynamics and theirs role in selection patients for invasive management of lower urinary tract dysfunction there may be a need for randomized controlled trials.

The third chapter entitled "Tape Positioning" written by M. Bogusiewicz and T. Rechberger describes the mechanism of action of midurethral slings, techniques of tape po-

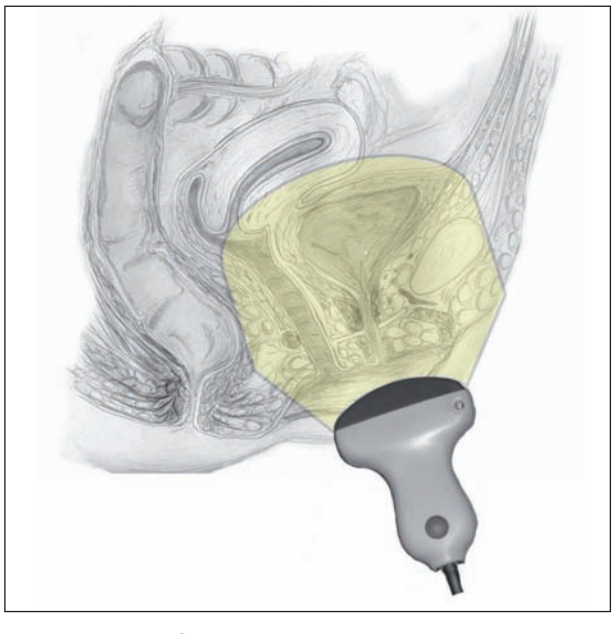

Figure 1a. — TPUS.

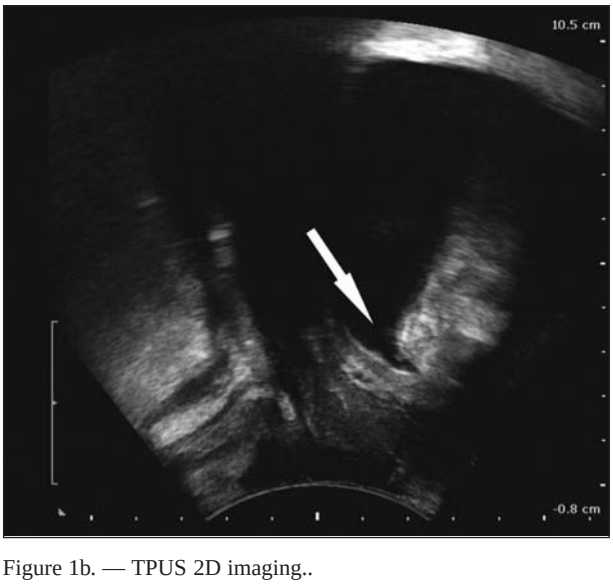

Figure 1b. — TPUS 2D imaging..

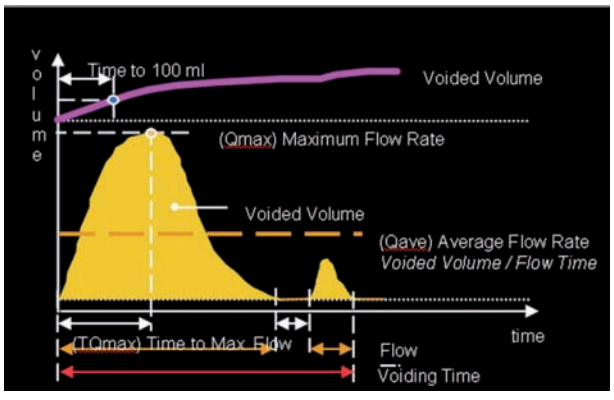

Figure 2. – Urodynamics.

sitioning and postoperative complications. Authors underline that appropriate support of the urethra is crucial for female urinary continence and the reinforcement of suburethral structures by implementation of a non-absorbable tape under the midurethra is a first-choice treatment for stress urinary incontinence in women. Among several currently available techniques for tape placement, procedures utilizing a retropubic or transobturator approach are the most widely used. The main mechanism of retropubic sling action relies on the angulation of the urethra on a fulcrum created by the tape. In the case of a transobturator sling, the urethral angulation occurs in only 24-50% of cured patients and continence is restored mainly as a result of urethral encroachment by the tape. Placement of the tape under the midurethra is associated with the best cure rate, however a subset of patients may be also cured even if the tape is located outside this zone. Regardless of the approach proper tape-location and tension-free placement seem to be crucial for successful treatment outcome, while inappropriate positioning of the tape may increase the risk of postoperative complications.

The fourth chapter "Selection of Midurethral Slings for Women with Stress Urinary Incontinence" by J. K. S. Lee and P. L. Dwyer includes a review of the variety of currently available slings and approaches. Most commonly used slings, showing most favourable safety and efficacy, are made of monofilament polypropylene mesh, however many other slings, including self-made, have been introduced. The choice of procedure is based on the surgeon's experience as well as clinical grounds. Women that respond best to midurethral sling surgery are those who have simple stress urinary incontinence (SUI), no intrinsic sphincter deficiency (ISD)/mixed urinary incontinence (MUI), no previous SUI or prolapse operations, and a mobile urethra. The skill and experience of the individual surgeon is an important factor in patient outcome and selection of the method. Systematic reviews and meta-analyses of randomized controlled trials comparing a retropubic and a transobturator approach have demonstrated equivalence in early to midterm efficacy. For women with urodynamic stress incontinence (USI) and intrinsic sphincter deficiency (ISD), the transobturator route is less effective than the retropubic approach. Available randomized controlled trials data are inadequate for definitive conclusions regarding the choice of slings in other important subgroups.

The fifth chapter written by P. Curti entitled "Injectable Biomaterials" describes in details the intra-urethral injections of bulking agents as an alternative technique to the traditional surgical procedures performed in curing stress urinary incontinence (SUI). The chapter describes different injection techniques performed under general, regional, or local anesthesia, according to the surgeon's preference. The complication rates of SUI injection therapy are acceptable low and can be divided into those that are generic to all substances or agent-specific complications. In order to improve the long-term outcome, newer and more durable substances have been investigated. The technique can be considered a useful option only for patients with comorbidity precluding anesthesia. The long-term efficacy however, is difficult to be established, as most of the published studies analyzed a small number of patients with short follow-up periods. Both periurethral and transurethral injections are equally efficacious, but there is evidence to suggest that the transurethral route results in fewer complications. Injection therapy is less effective than surgery, but has a better safety profile.

The sixth chapter "Artificial Urinary Sphincter in Women" by A. R. Rao and P. Grange describes this method of restoring continence when other methods have failed. Artificial urinary sphincter (AUS) is a surgical device that is implanted to restore continence in men, women, and children. In women, AUS is usually considered as the last resort to restore continence after failure of other anti-incontinence procedures, however, there are also indications for primary insertion of AUS. The procedure requires appropriate patient selection to avoid disappointments. Operative insertion should be performed by a surgeon well versed with the anatomy of the pelvis and possessing sound knowledge of reconstructive techniques, as the procedure can be difficult due to previous surgeries and can carry a significant morbidity. Postoperative follow-up should be rigorous to pick up complications and manage them accordingly. Traditionally and open abdominal approach has been used to implant the AUS, however, recently laparoscopic insertion is gaining popularity with the advantages attributed to minimally invasive surgery.

The seventh chapter by G. Tuccitto, F. Beniamin, E. Ostardo and L. Maccatrozzo is devoted to "Sacral Nerve Stimulation". The chapter describes the method of sacral neuromodulation which is an established treatment in case of non-neurogenic patients. Recent reports have shown that the method has a sustained efficacy and acceptable safety profile in the long term. The most common adverse events such as lead migration, infection, and pain at the implantation site are transient and can be treated effectively. The complication rate using the tined lead is low. It does not carry the risk of systemic side-effects encountered in pharmacologic therapies, or the potential morbidity that open surgical procedures may carry. There are no permanent sequelae following adverse events and the procedure is completely reversible. The major frontiers for sacral neuromodulation in adults are interstitial cystitis and chronic pain syndromes, neurogenic bladder from spinal cord injury, fecal incontinence, constipation and erectile dysfunction. Sacral nerve stimulation should be considered before using a more invasive procedure.

The eighth chapter of the section four written by K. Bo and P. Di Benedetto describes "Biofeedback", which is a common name for a group of experimental procedures where an external sensor is used to give an indication on bodily processes, usually for the purpose of changing the measured quality. Pelvic floor muscle training (PFMT) can be conducted with and without biofeedback. The chapter gives an overview of randomized controlled trials comparing the results of PFMT with and without biofeedback on stress and mixed incontinence. While a few studies showed improved pelvic floor muscle function in favour of using biofeedback, none of the trials showed statistically significant improvement of urinary incontinence when biofeedback was added to the training. Based on the existing evidence from randomized controlled trials PFMT is effective

when used alone, and biofeedback is not necessary to achieve efficacy. However, some patients may be motivated to adhere to a training program and work harder using biofeedback. If available, interested and cooperative patients should be given the option to use this method.

The ninth chapter of this section written by F. Pesce and M. A. Cerruto is entitled "Medical Treatment of Urinary Incontinence, Urinary Retention, and Overactive Bladder". The authors describe pharmacologic management of lower urinary tract dysfunctions. Antimuscarin drugs represent the first-line treatment in case of overactive bladder syndrome (OAB). Over the last 10 years the use of botulinum neurotoxin has revolutionized the treatment of symptoms associated with OAB. The pharmacological treatment of chronic urinary retention with and without urinary incontinence (UI) has the purpose of preventing damage to the upper urinary tract by normalizing bladder emptying and endourethral pressures. Many drugs have been proposed for a range of possible central and peripheral pharmacologic targets in urinary incontinence, but often with disappointing results because of poor efficacy and side-effects. A growing understanding of the biochemistry and physiology of lower urinary tract function – focused mainly on the role of cholinergic and adrenergic receptors – has led to the development of pharmacologic agents with specific lower urinary tract targets. The development of pharmacologic treatment for urinary incontinence is slow, and the use of some drugs that are currently marketed and prescribed is based on tradition rather than evidence-based medicine and patient's expectations.

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Book review

As announced in the Editorial by Bruce Farnsworth (Pelviperineology 2011; 30:5) this is the fifth of a series of articles highlighting the different sections of the book "Pelvic Floor Disorders, Imaging and a Multidisciplinary Approach to Management" edited by G.A. Santoro, P. Wieczorek, C. Bartram, Springer Ed, 2010.

Fecal incontinence

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The *fifth section* of the book "Pelvic floor disorders-Imaging and Multidisciplinary Approach to Management" entitled "Fecal Incontinence" consists of twelve chapters divided into two subsections describing diagnostic modalities and management for this disorder.

In the first chapter "Three-dimensional Endoluminal Ultrasonography" G. Di Falco and GA Santoro describe the role of endoanal ultrasonography in the patients with fecal incontinence. This technique is considered the gold standard in the assessment of anal sphincters and enables to differentiate between incontinent patients with intact anal sphincters and those with sphincter lesions (defects, scarring, thinning, thickening, and atrophy). High-resolution multiplanar reconstructions and rendering techniques available in 3D imaging (Figure 1a-b) enhance the accuracy of EAUS and its diagnostics value allowing for instance detection of occult sphincter tears. The technique also serves as a tool to establish the most appropriate therapy (sphincteroplasty, graciloplasty, injection of bulking agents, sacral nerve stimulation) and to monitor results following surgical treatment.

In the second chapter entitled "Transperineal Ultrasonography", B. Roche, G. Zufferey and J.R.Yap present the transperineal ultrasound as an easy to perform, fast examination in the assessment of rectoceles, intussusceptions, evacuatory apparatus lesions, and perineal muscle movement. This technique allows to evaluate this disorders quickly and accurately and prescribe appropriate therapy. Authors reported that measurement of displacement of the puborectal sling enables prediction of sphincter repair outcome as a treatment of fecal incontinence, which has an important clinical value. Moreover, the reproducibility of this test is rather good, and the technical training period quite short.

In the third chapter "Magnetic Resonance Imaging" J. Stoker describes the technique, patient preparation and imaging findings in the patients with fecal incontinence. Endoanal MRI has been demonstrated to be comparable to endoanal ultrasound in the detection of external sphincter defects and could be used as an alternative, especially in cases with external sphincter atrophy. External sphincter atrophy at endoanal MRI has been demonstrated to be a negative predictor of the outcome of anterior anal repair. Thus, in candidates for anterior anal repair, endoluminal MRI should be considered, in order to identify patients with external sphincter atrophy.

In the fourth chapter entitled "Anorectal Manometry", F. Pucciani reviews information on anorectal manometry. Its clinical utility is limited by the relative absence of standardization of test protocols and normative data from a large number of healthy individuals, however anoretcal manometry is considered a valuable functional test for the diagnosis and management of fecal incontinence. When anorectal manometry is used in incontinent patients, its data suggest which continence mechanisms may be malfunctioning. However, manometric findings in incontinent pa-

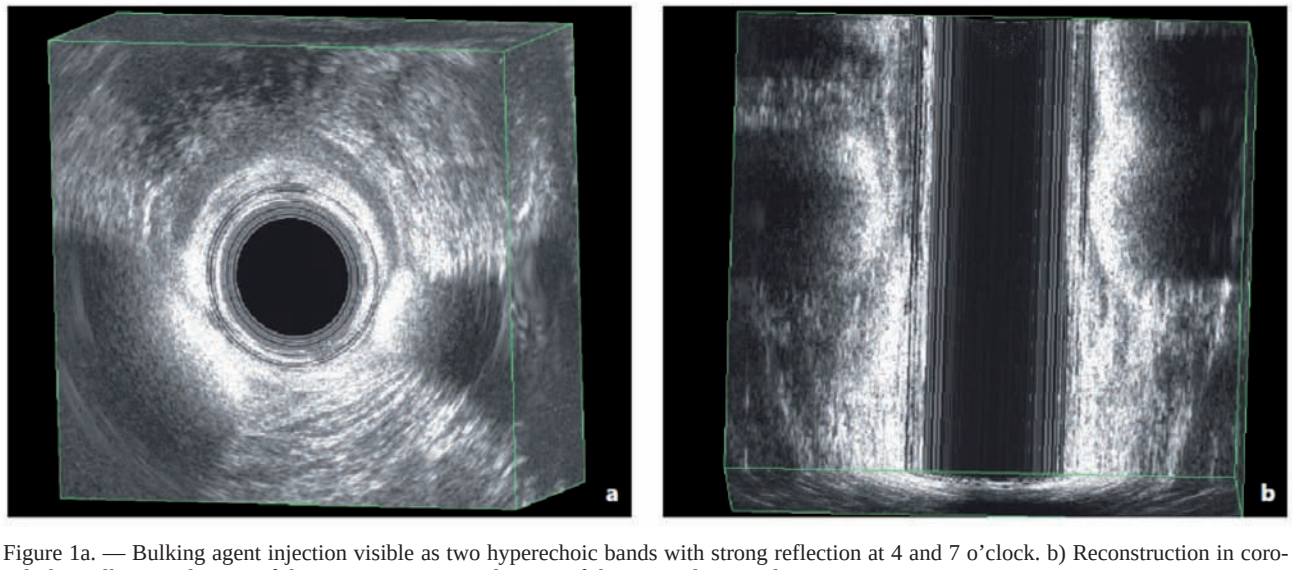

Figure 1a. — Bulking agent injection visible as two hyperechoic bands with strong reflection at 4 and 7 o'clock. b) Reconstruction in coronal plane allows evaluation of the correct position and extent of the injected material.

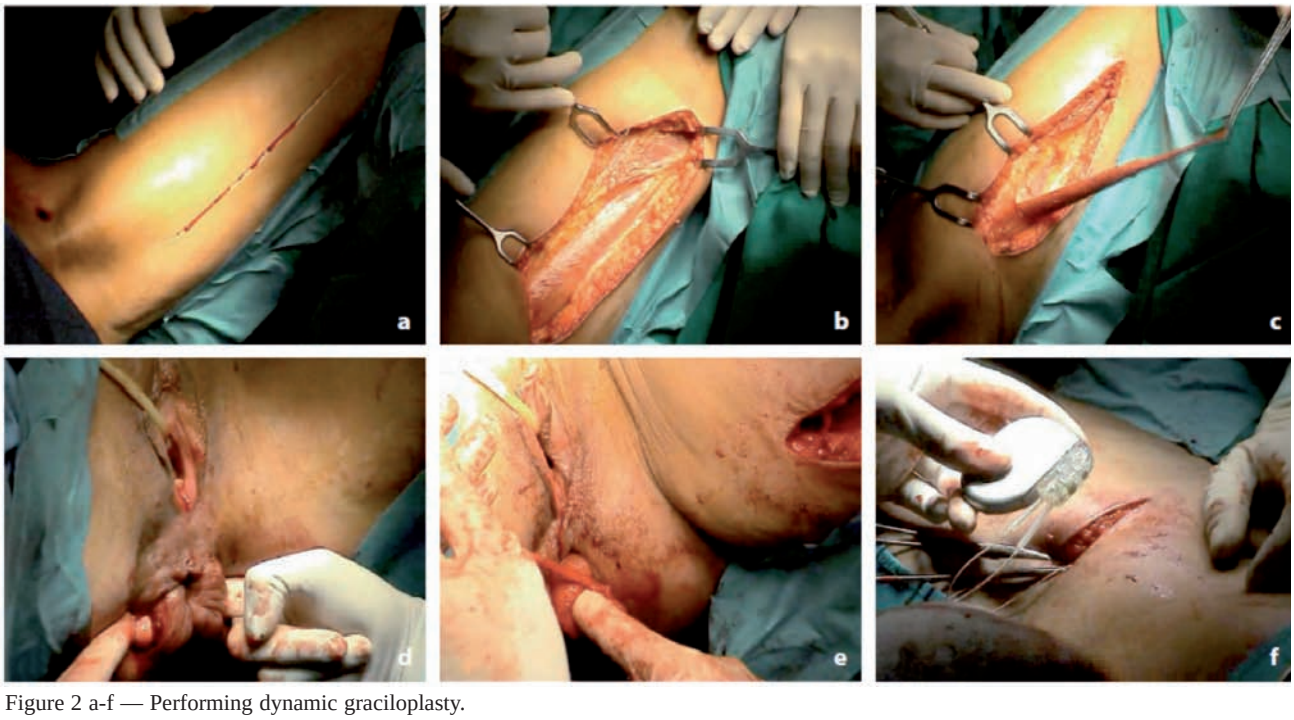

Figure 2 a-f — Performing dynamic graciloplasty.

tients are not specific and must be completed with data obtained using other diagnostic techniques, such as MRI, endoanal ultrasound and anal neurophysiologic tests, to obtain a correct pathophysiological profile of incontinence.

In the fifth chapter "Sphincter Repair and Postanal Repair" J. Pfeifer updates information on traditional surgical treatment of fecal incontinence. Sphincter repair can be done either as a direct repair or as an overlapping sphincteroplasty. For idiopathic fecal incontinence, the method of postanal repair has been described. Short-term results (<5 years) for overlapping sphincter repair are successful in about 75% of patients. In the long run over 10 years, the success rate decreases significantly and ranges from about 20% to 30%. Despite poor long-term results, sphincteroplasty is the best and cheapest surgical treatment option for isolated, preferably anterior sphincter defects. Physiological tests are useful for planning an operation, but they do not necessarily reflect the quality-of-life outcome in these patients. At present, postanal repair is not considered as a first-line treatment in idiopathic fecal incontinence.

The sixth chapter by C. Ratto entitled "Dynamic Graciloplasty" provides information on this surgical tehnique, which purpose is to substitute sphincters that are affected by a very wide or multiple lesion or severe functional impairments causing fecal incontinence. Dynamic graciloplasty (DG) is based on transposition of the gracilis muscle around the anal canal; moreover, electrical stimulation of the gracilis nerve pedicle is usually added to guarantee the functional "dynamicity" of this correction (Figure 2a-f). The most common clinical indications for DG is fecal incontinence secondary to congenital malformations, multiple sclerosis, or cauda equina neurinoma, and severe lesions of the external anal sphincter. Additionally, DG has been used in total ano-rectal reconstruction following an abdomino-perineal resection. The results of DG have been variable. Continence rates range from 35% to 85%, with the best results being obtained in the centers with higher surgical volume. Mortality rates range from 0% to 13%, and morbidity has occurred in more than 50% of patients. Evaluation of DG outcome in terms of clinical improvement of fecal incontinence is still debatable. The final results are conditioned by the adverse events related to development of postoperative complications.

The seventh chapter entitled "Radiofrequency Energy and Injectable Biomaterials" written by M. Trompetto and M. Roveroni describes the use of radiofrequency and injections with different types of biomaterials for the treatment of fecal incontinence. Over last 5-10 years these methods have gained attention from coloproctologists because of their safety and feasibility. The initial functional results have been encouraging, although more recently their long-term effectiveness has been questioned. The possibility of performing the treatment as a day case operation is a great advantage both for surgeons and patients. These options can be a good alternative in cases of minor fecal incontinence, when a sphincter defect is minimal or absent, or when previous surgery to treat the functional disorder has failed.

Chapter eighth by G. Romano, F. Bianco and L. Caggiano is devoted to "Artificial Bowel Sphincter". Authors describe the procedure of the implantation of the artificial bowel sphincter (ABS), which seems to be easy and quick, however related to the high risk of system malfunctioning, infection, and explantation. Also morbidity and the need for revision surgery is high, but the outcome in terms of continence and quality of life is significantly improved, so that ABS may be considered and effective treatment option for severe fecal incontinence. Patients should be well informed and their skill to manage the device evaluated. When all the other treatment options have failed, the ABS procedure should be proposed, particularly in young and motivated patients, as it remains the only alternative to a definitive colostomy.

The ninth chapter of the section five by D. F. Altomare, M. Rinaldi and F. Cuccia entitled "Sacral Neuromodulation" describes the method of sacral nerve stimulation (SNS), a minimally invasive treatment available for fecal incontinence, involving electrostimulation of the sacral nerves by means of implantable pulse generator. Despite the fact that the exact mechanism of action is still incompletely known, SNS has gained wide acceptance among colorectal surgeons for its ability to influence several factors responsible for continence, and as a reliable pre-im-

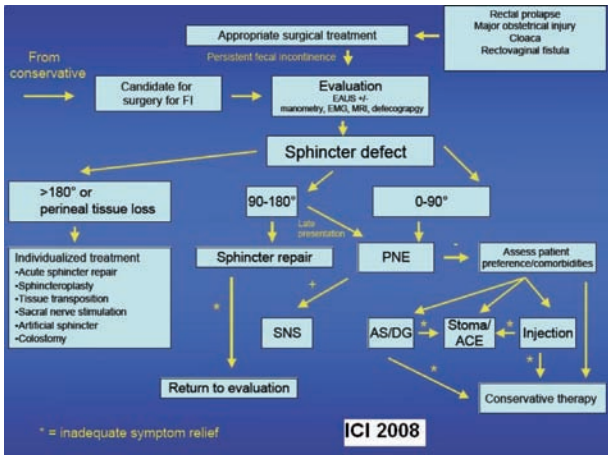

Figure 3. – Algorithm on the management of fecal incontinence by the ICI 2008.

plantation test, with very low surgical risk and a wide range of indications. About 15 years since the introduction of the method in coloproctology, studies on the long-term outcome have confirmed its reliability and effectiveness, not only in symptom control but also in improving quality of life. Evaluation of cost-effectiveness ratio compared with other treatments for fecal incontinence confirms the advantages of SNS, making this technique the first option in the management algorithm of this disease.

Chapter tenth "Future Treatment" by B. Roche, G. Zufferey and J. Robert-Yap describes the future of incontinence treatment, which will be guided by the increasing risk of the ever-aging population. Prevention of risk factors such as more conservative delivery techniques or less aggressive anal surgery will reduce the number of incontinent patients (Figure 3). Concerning therapy, new imaging will be helpful to plan surgical treatment and reduce organ injuries. The area of nerve stimulation will continue to play a large role, and the development of direct pudendal nerve stimulation has yet to reveal its long-term effectiveness. Finally, the substitution of old and degenerative tissues by new tissue derived from stem cells is a promising way to treat general tissue degeneration.

The chapter eleventh by B. Salvioli and L. Pellegrini describes "Biofeedback", a conservative treatment that is widely recognized to be, along with lifestyle modifications and pharmaceutical support, one of the first-line approaches in fecal incontinence. Although data in the literature are controversial with regards to its benefit, and studies lack standardized protocols, this technique is relatively easy, readily accepted by patients, has no side-effects, and is of great help for patients' physical and psychological well-being. Predictors of outcome are not well established. Future placebo-controlled randomized studies are needed to better evaluate the efficacy of the method.

Chapter twelfth written by P. F. Almerigi, V. Ciaroni and G. Bazzocchi entitled "Medical Treatment" encompasses information about conservative treatment of fecal incontinence, which should always be the first approach to the disease. Conservative approach with changing of bowel habits, hygienic measures, dietary modifications, and medical treatment may be considered for minor degrees of fecal incontinence. Other indications for non-operative options are surgical failure and neuropathic incontinence. The best choice of medical treatment can be reached through an accurate integration of clinical features and instrumental diagnostic results. The main goal of conservative treatment should be not the complete resolution of dysfunction but the improvement of symptoms and the quality of life.

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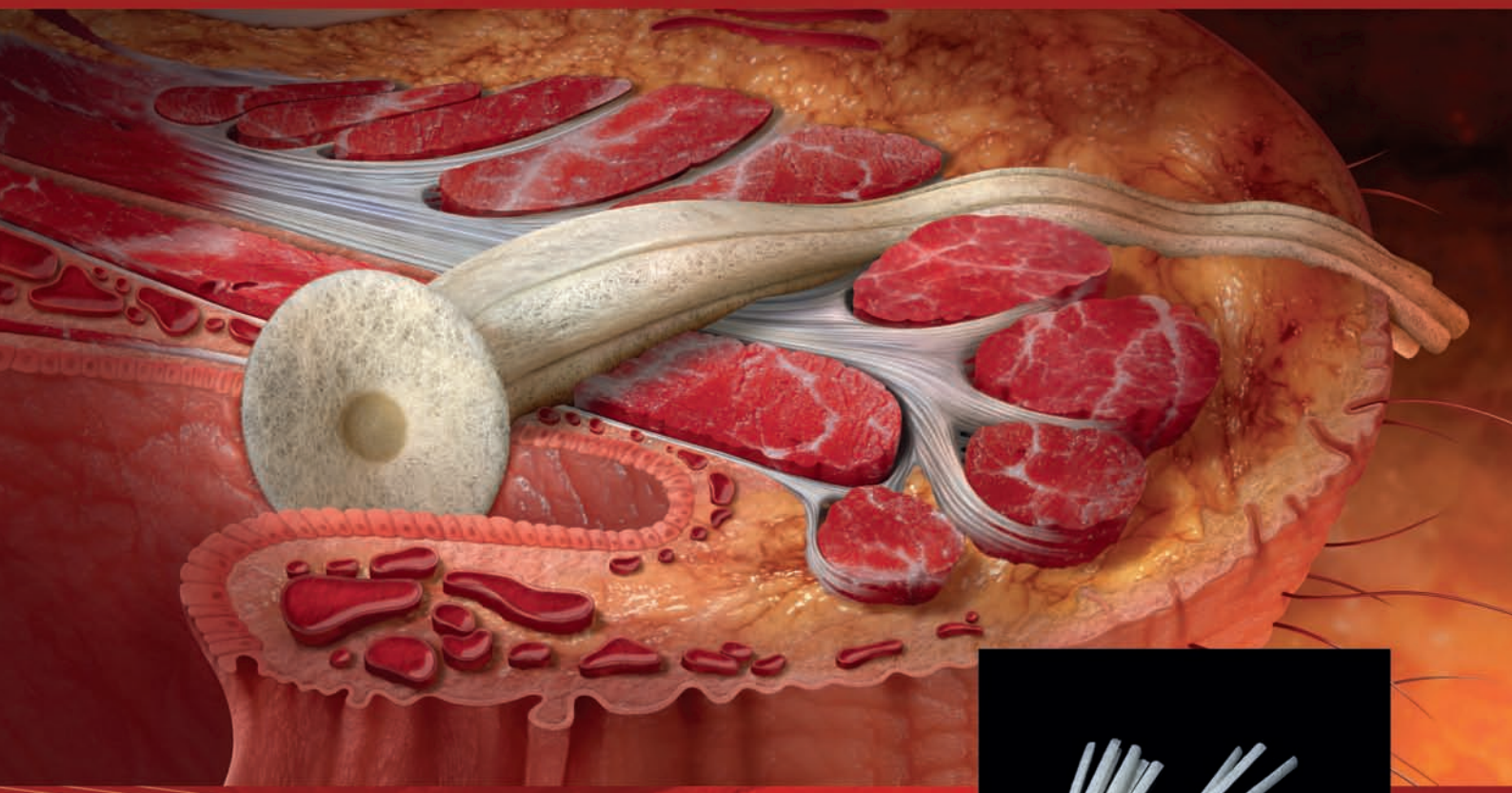

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