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NERVE PRESERVATION IN TENSION FREE VAGINAL MESH PROCEDURES FOR PELVIC ORGAN PROLAPSES: A CADAVERIC STUDY USING FRESH AND FIXED CADAVERS.

Hypothesis / aims of study

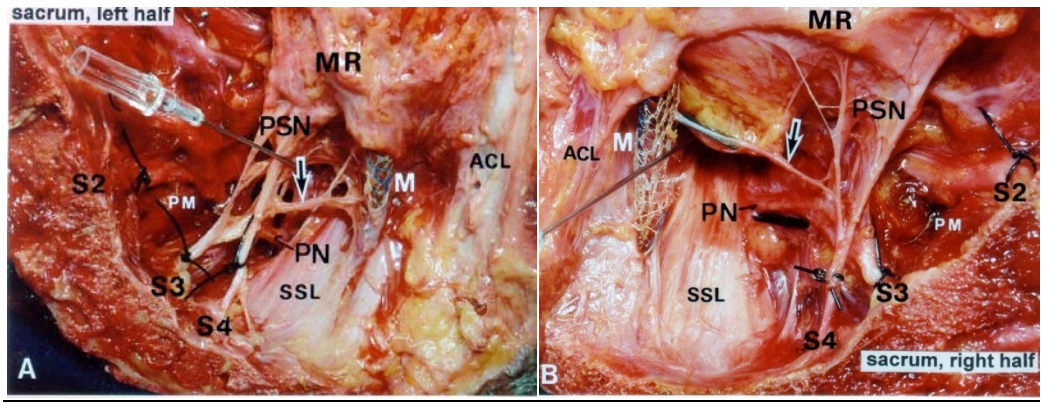
Since 1996, vaginal mesh surgery for treatment of pelvic organ prolapse has been developed and performed in several procedures(1). Among these procedures, tension-free vaginal mesh (TVM) procedure is expected to be one of the most competent procedures for the reconstruction of the pelvic floor because of low morbidity due to the vaginal approach, preservability of uteri, improved long-term results with the progress of the prosthetic material and applicability to almost all types of the pelvic organ prolapse. The TVM procedure is composed of anterior TVM (TVMA) procedure and posterior TVM (TVMP) one. The TVMP procedure includes penetration of a needle to insert mesh arms through the sacrospinous ligament. Among various important nerves running in a female pelvis , the levator ani nerve should be located near the ligament according to the Penkopf's atlas and other studies(2). Nobody can deny critical importance of the levator ani mucle as an essential engine for the dynamic suspension of the pelvic floor. However, to the best of our knowledge, no surgeon has paid attention to preserve the levator ani nerve possibly because the nerve is believed to take a deep course away from the surgical margin. The aims of this study are 1) to identify the actual pathways of important nerves including the levator ani nerves along and around the sacrospinous ligaments through which arms of the mesh pass during TVMP procedure, 2) to experimentally make sure of possibility of nerve injury during the procedure and 3) to propose feasible safer skills of TVMP for preservation of the nerve.

Study design, materials and methods

To attain the aims of the study, we performed 1) macroscopic dissections of 10 fixed cadavers to identify variations of the levator ani nerve course, 2) topohistological observations of the nerves and other pelvic floor structures using paraffin-embedded semiserial sections obtained from 2 fixed cadavers and 3) fresh cadaver dissection of cadavers to identify applied mesh and nerves after trial of TVMP according to the technique for patients. The surgical procedure was the same as the original description by the TVM group in France(3) . TVM procedure was performed by the first author using fresh cadavers after thawing process in 0.5% sodium azide solution for bacterial control. He had already performed 175 TVM operations for pelvic organ prolapse cases including 92 cases of TVMP procedures. His short-term results are as good as those reported by the TVM group. Mesh used in this study was soft polypropylene mesh (Gynemesh PS®) being trimmed in the same shapes as those used in real operation. The core shapes of the mesh were almost the same as those used in the Gynecare Prolift® system.

Results

The macroscopic dissections of fixed cadavers demonstrated that the levator ani nerve crossed the inside of the sacrospinous ligament (or the coccygeus muscle) at a point 0-18 mm (average, 4.8 mm) medial to the ischial spine and it ran anteriorly along the levator ani muscle. The nerve inserted the muscle at a point 12-26 mm (average, 18,5 mm) inferior to the ischial spine and 40-55 mm (average, 51,2 mm) anterolateral to the coccyx. Moreover, the present histology strongly suggested that, in living status or patients, the pelvic splanchnic nerve as well as the levator ani nerve were located closely to the ligament along their long course. Finally, the application of mesh in TVMP for fresh cadavers and the following dissections showed that the penetration point of mesh through the ligament was likely to be located very close to the levator ani nerve (Figure).



Figure; Levator ani nerve and the inserted mesh in fresh cadaver dissections.

Panels Aand B are different specimens: 60 and 83 years-old women, respectively. Medial view of the left (panel A) or right (panel B) half of the pelvis after bisection. The pelvic viscera are reflected anteriorly and the pelvic splanchnic nerves (PSN; S3-S4 origins) display a straight course. The levator ani nerve (white and black arrow) makes a common trunk with the PSN and crosses the inside of the sacrospinous ligament (SSL), whereas the pudendal nerve (PN) goes to the outside of the SSL. Needles indicate the ischial spine. In panel A, the arm of mesh penetrates the lower part of

the SSL and appeared inside of the pelvic floor closely (ca 3 mm) to the levator ani nerve course. In contrast, in panel B, the penetration point of mesh along the SSL is away from the nerve although it is located near the nerve. Abbreviations for the figures: ACL, anococcygeal ligament; LAM, levator ani muscle; PM, piriformis muscle; PN, pudendal nerve; PSN, pelvic splanchnic nerves; S1-S4, ventral roots of the sacral spinal nerves; SSL, sacrospinous ligament.

Interpretation of results

The present study demonstrated 1) the location of the levator ani nerve running across the surface of the sacrospinous ligament and 2) topographical relation between the nerve and a penetration site of the applied mesh arm. These morphologies displayed interindividual difference if the TVMP techniques were stable. However, because the dissection was limited to along and on the sacrospinous ligament, we did not find interindividual variations of ramification pattern of the levator ani nerve. In addition, in contrast to observations after dissection, the present histology made sure of a fact that the pelvic splanchnic nerves ran near the ligament “before” dissection or operation

Concluding message

The pelvic splanchnic nerve could be successfully separated from the applied mesh by experienced blunt dissection with a finger with the aid of Breisky speculum. To preserve the levator ani nerve in patients with normal pelvic floor function, we postulated a penetration of the sacrospinous ligament at a point 20-25 mm medial from the ischial spine and within 5mm from the lower margin of the ligament. We hypothesized that, when the anal tonus of the patient is normally identified with digital examination, it seems valuable to preserve the levator ani nerve because the external anal sphincter is anatomically suspended by the muscle.

References

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