

Study No. 7: Role of puborectalis muscle in anal continence. Comments on original 4D pelvic ultrasound data from Chantarasorn & Dietz

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Abstract: External 4D ultrasound data from Chantrasorn and Dietz demonstrating no relationship between fecal incontinence and avulsion of the puborectalis was used to challenge the Theory's prediction of puborectalis function. The results were consistent with the Theory's hypothesis that the role of puborectalis may be more to immobilize the anorectum than create primary closure per se.

Key words: 4D Ultrasound; Puborectalis avulsion; Fecal incontinence.

INTRODUCTION

We report in full, an abstract of important findings by Chantarasorn V, and Dietz HP, with kind permission of Associate Professor Dietz, University of Sydney, Nepean Clinical School. The Abstract quoted was presented at ASUM Auckland 2008 (Australasian Society for Ultrasound in Medicine).

The authors, Chantrasorn and Dietz, found no association between levator ani function and anatomy on the one hand and anal continence on the other hand, indicating that there may be no major role for the puborectalis muscle in anal continence.

Title: How important is the puborectalis muscle for anal continence? by Chantarasorn V and Dietz HP

Objective: The levator ani muscle is believed to play an important role in anal continence. However, to date there is very limited evidence to support this hypothesis. This study was designed to test for an association between puborectalis trauma and ballooning of the levator hiatus on the one hand and anal incontinence on the other hand.

Methods: The records of 401 women who had attended a tertiary urogynecological clinic were reviewed in a retrospective study. The history included questions on feces urgency, soiling, flatus and fecal incontinence. Examination included levator assessment by palpation and 4D pelvic floor ultrasound.

Results: Mean age on presentation was 54 (18-89) years. Median vaginal parity was 2 (0-9). 22% complained of fecal urgency, 16% of fecal incontinence, 16.5% of soiling, and 22.8% of flatus incontinence. 17.7% of patients were diagnosed with levator avulsion, out of which 7.1% were bilateral. Levator avulsion was not associated with fecal incontinence ($P = 0.9$), fecal urgency ($P = 0.9$), or soiling ($P = 0.5$). Flatus incontinence was the only symptom found to be associated with levator trauma; but this association was weak (χ^2 , $P = 0.01$). Hiatal dimensions at rest or on Valsalva were also found not to be associated with symptoms of anal incontinence.

DISCUSSION

The authors, Chantrasorn and Dietz, found no association between puborectalis avulsion and anal continence. These findings run contrary to orthodox thinking, that the puborectalis has a major role in anorectal closure. However, these findings are consistent with the Theory's hypothesis, that puborectalis contraction is only the first part of a more complex closure mechanism: it stabilizes the anorectum for anorectal closure by backward/downward stretching of the rectum by LP/LMA directional forces, (arrows, Fig. 1). Stretching and narrowing exponentially increase resistance in proportion to the 4th power of the radius (Poiseuille's law). Viscosity, friction, length and radius of the viscus (tube) are the major variables, but the radius of the tube is the major factor governing flow rate. It is the reduction in radius that

accounts for the increase in resistance, which prevents outflow of feces.^{1,2} For example, if the rectal tube can be narrowed to half its diameter, the internal resistance to outflow of feces increases by a factor of 16 ($2 \times 2 \times 2 \times 2$). As regards closure, the puborectalis can only compress the anorectum laterally. It cannot provide the stretching and narrowing so essential for the very high resistance required to effect airtight and watertight anorectal closure. Such an action can only be effected by the downward/backward muscle forces 'LP/LMA' (arrows, Fig. 1) stretching the rectum to create a more acute anorectal angle, Fig. 1. According to the theory, forward contraction of the anterior portion of pubococcygeus against the perineal body (Study No. 1), will still provide stabilization of the anterior anal wall permitting sufficient stretching and rotation for closure as in Fig. 1. Such an explanation is consistent with puborectalis avulsion being related to only the mildest form of FI, the flatus incontinence described in Chantrasorn and Dietz's study.

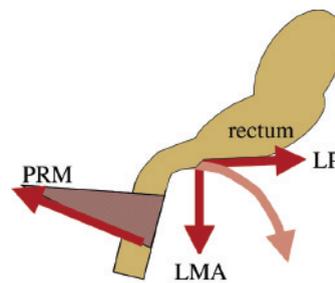


Fig. 1. – The principal closure mechanism for the anorectum is stretching and narrowing of the rectal tube by posterior muscle forces (arrows) acting against an anus immobilized by puborectalis (PRM) contraction. This action increases the resistance to leakage exponentially inversely with the 4th power of the diameter. LP = levator plate; LMA = longitudinal muscle of the anus.

CONCLUSIONS

With regard to Fig. 1, it can be concluded that puborectalis may not, per se, have a major role in anorectal continence. The findings are consistent with the theory's prediction that the role of puborectalis may be principally to anchor the anorectum for watertight closure by the rotational forces exerted by the LP/LMA vectors, which also create the anorectal angle.

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