Levator avulsion is a risk factor for cystocele recurrence

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KEYWORDS: anterior colporrhaphy; avulsion; cystocele; levator ani; prolapse; recurrence

ABSTRACT

Objectives To determine whether levator avulsion is a risk factor for recurrence after cystocele repair.

Methods This was an audit of women who underwent anterior colporrhaphy at a tertiary hospital between 2002 and 2005, who were followed up by interview, clinical examination and four-dimensional translabial ultrasound examination 3–6 years later.

Results Of 242 patients identified through theater records we were able to contact 171 (71%). Of 83 who agreed to attend, 24 (29%) reported symptoms of recurrent prolapse. There were 33 (40%) recurrent cystoceles (Stage 2+), and 34 (41%) had a significant cystocele on ultrasound examination. On pelvic floor tomographic ultrasound examination, a levator avulsion was detected in 29 (35%) patients. The relative risk of recurrence in women with avulsion was 3.9 (95% CI, 2.4–5.8) when ultrasound criteria of recurrent cystocele were used, and 2.9 (95% CI, 1.7–4.5) when using clinical staging.

Conclusion Levator avulsion is associated with a relative risk of 3–4 for cystocele recurrence after anterior colporrhaphy. Copyright © 2010 ISUOG. Published by John Wiley & Sons, Ltd.

INTRODUCTION

Vaginal childbirth seems to be the cause of major morphological abnormalities of the levator ani muscle1, which are thought to arise during crowning of the fetal head. Such defects (‘avulsion’) are common2–6 and likely to be an etiological factor in the development of female pelvic organ prolapse7–9, especially cystocele and uterine prolapse8. Defects of the insertion of the puborectalis on the os pubis may also be a risk factor for prolapse recurrence because such defects enlarge the levator hiatus9. A larger hiatus may place greater strain on the anterior vaginal wall, exposing a larger part of it to the pressure gradient between intra-abdominal and atmospheric pressure.

Recurrence after prolapse surgery is common, with up to one-third of all procedures performed for recurrence10. Anterior compartment recurrence seems to be a particular problem11, and to date no strong predictors of recurrence have been identified, apart from recurrence in itself, and possibly prolapse severity12. In a recent study the size of the genital hiatus has been suggested as a predictor of recurrence13. An abstract presented in 2005 suggested that defects of the levator muscle may be a risk factor for recurrence of cystocele, although at the time the authors seemed to misinterpret levator defects as paravaginal fascial defects14.

We undertook a long-term audit of anterior colporrhaphy at a single tertiary unit in order to estimate recurrence rates at 3–6 years in women with and without avulsion of the puborectalis muscle, as diagnosed on translabial tomographic four-dimensional (4D) ultrasound15, and to determine whether levator avulsion is a risk factor for recurrence.

METHODS

Over a period of 4 years (January 1 2002 to December 31 2005) a total of 242 anterior colporrhaphy procedures without mesh augmentation were carried out at our institution, and at the co-located private hospital, by or under the supervision of a total of seven senior gynecologists. We invited patients for a follow-up appointment that included a structured interview, clinical examination using the ICS POP-Q assessment, and 4D translabial ultrasound examination using a Voluson 730 Expert system (GE Healthcare Ultrasound, Milwaukee, WI, USA) with a RAB 8–4-MHz transducer, as previously described16. All patients gave written informed consent. The hiatal area on Valsalva was determined in the plane of minimal dimensions17. Organ descent was measured on
maximum Valsalva (non-standardized) at the time of the clinical assessment, as previously described\(^{18}\). Ultrasound volume data were stored and subsequently analyzed for levator avulsion, with the operator blinded against all clinical and ultrasound data, including any information describing organ descent. To diagnose levator trauma we assessed volumes obtained on maximum pelvic floor muscle contraction or, if that was not possible (\(n = 3\)), at rest. An avulsion was diagnosed on tomographic ultrasound imaging (TUI), as previously described\(^{15,19}\). A tomographic representation of the lower aspects of the levator ani muscle and hiatus is obtained by identifying the plane of minimal dimensions\(^{17}\) in the axial plane of a volume registered on maximal pelvic floor contraction. Two slices are added caudal to this plane and five slices are added cranial to this plane, at an interslice interval of 2.5 mm. This procedure seems to cover the entire pubococcygeus and the lowermost aspects of the iliococcygeus muscle. We consider an abnormality to signify a complete avulsion of the puborectalis muscle if the three central slices (i.e. the one obtained at the level of the plane of minimal hiatal dimensions and the two immediately cranial) show an abnormal muscle insertion on one side. This methodology has recently been shown to be the most valid option for diagnosing functionally relevant trauma\(^{20}\) and correlates well with findings on palpation\(^{21}\). Defects above this region often seem to indicate trauma of the iliococcygeus rather than the pubococcygeus muscle. Figure 1 shows a typical left-sided avulsion in a patient with cystocele recurrence 6 years after a vaginal hysterectomy and anterior colporrhaphy. Overall diagnosis and TUI score (i.e. the total number of abnormal slices detected on tomographic imaging) as explanatory parameters were tested against the outcome parameters of (a) symptoms of prolapse, (b) significant cystocele of \(\geq\) Stage 2 on the prolapse quantification system of the International Continence Society (ICS POP-Q\(^{22}\)) and (c) significant cystocele on ultrasound examination (leading edge of the bladder \(\geq 10\) mm below the symphysis pubis on maximal Valsalva\(^{23}\)).

This study was approved by the local Human Research Ethics Committee (Sydney West Area Health Service Human Research Ethics Committee, ref. 07–063). Statistical analysis was performed using the website http://statpages.org/ctab2x2.html for relative risk and OR. The TUI score was tested against recurrence using the Mann–Whitney \(U\)-test using Minitab version 13 (Minitab Inc., State College, PA, USA).

**RESULTS**

Of 242 eligible patients we were able to contact 171 women (71%), of whom 91 agreed to attend for an interview and assessment (53%). At the time of the assessment it became clear that eight patients were not eligible to participate because of later surgery affecting the anterior vaginal wall (\(n = 5\)), because they had not, in fact, undergone an anterior colporrhaphy (\(n = 2\)) or because of an incidentally discovered urethral diverticulum (\(n = 1\)), leaving 83 assessments. All subsequent analysis relates to this dataset. Figure 2 shows a flow chart of the study population and selected results.

Mean age at assessment was 61 years (range, 34–86), and the mean follow-up interval was 4.5 years (range, 3–6.4). Thirty-five women had undergone a concomitant vaginal hysterectomy, 41 a posterior repair and 12 placement of a suburethral sling. Mean body mass index was 28.4 (range, 18–45). Median vaginal parity was 3 (range, 1–9) and 24 (29%) reported a previous hysterectomy. In six (7%) cases the anterior colporrhaphy was a repeat procedure. Of 83 women, 54 (65%) were satisfied with the outcome of their procedure, and 59 (71%) felt improved or cured. Twenty-four (29%) reported symptoms of recurrent prolapse. On clinical
examination the mean for point Ba (most distal position of the anterior vaginal wall) was −1 (range, −3 to 6). In 33 (40%) cases we diagnosed a recurrent cystocele (ICS POP-Q ≥ Stage 2). There was one uterine prolapse (Stage 2+), three enteroceles and 22 (27%) rectoceles. In total, we found a prolapse of Stage 2 or higher in 45 (54%) women.

On ultrasound examination, mean bladder neck descent was 29.2 (range, 2.8–60.7) mm, and maximal descent of the bladder was a mean of 7.8 mm below the symphysis pubis (range, 30.3 mm above to 43.7 mm below). In total, 34 (41%) women were found to have a significant cystocele seen on ultrasound examination (leading edge ≥ 10 mm below the symphysis pubis). There was a fairly high concurrence of clinical and ultrasound results, with only 11/83 (13%) patients classified differently (recurrence/no recurrence) by the two diagnostic modalities. In the axial plane, the levator hiatus measured 30.3 cm² (range, 17.9–58.3) on average. Levator avulsion was detected in 29 women (35%). It was more commonly found on the right (n = 25) than on the left (n = 16), was unilateral in 17 women (21%) and bilateral in 12 women (14%). The median TUI score was 2 (range, 0–16). There was no association between recurrent symptoms of prolapse, patient satisfaction or subjective cure/improvement and objective prolapse (P = 0.34, P = 0.59 and P = 0.64).

A significant cystocele was detected on ultrasound examination in 23 out of 29 women with avulsion (79%) and in 11/54 (20%) of those without avulsion (P < 0.001). This equates to a relative risk of 3.9 (95% CI, 2.4–5.8). Cystocele recurrence on ultrasound examination was associated with a significantly larger hiatal area on Valsalva (27.6 vs. 34.93 cm², P < 0.001). Similar figures were obtained on clinical examination: of 54 women without avulsion, 13 (24%) had a cystocele of ≥ Stage 2, whereas this was the case for 69% of those with avulsion (20/29, P < 0.001), giving a relative risk of 2.9 (95% CI, 1.7–4.5). Women with clinical cystocele recurrence also had a significantly greater hiatal area on Valsalva (34.12 vs. 28.0 cm², P = 0.001). Table 1 shows the relative risks for clinical and sonographic recurrence, separately, for unilateral and bilateral avulsion. When TUI scores were tested against clinical cystocele recurrence and ultrasound measures of bladder descent, again there was a highly significant relationship. The TUI scores were higher in women with a significant cystocele seen on ultrasound examination (7.9 vs. 2.5, P < 0.001) or on clinical examination (3 vs. 7, P = 0.002), but there was no association between prolapse symptoms and avulsion.

**DISCUSSION**

Recurrence of prolapse after pelvic reconstructive surgery for female pelvic organ prolapse is common, and it seems that the anterior compartment poses the greatest challenges for the reconstructive surgeon. In the literature, recurrence rates of up to 70% are reported at follow-up after cystocele repair. The limited success of traditional anterior colporrhaphy has recently resulted in a profusion of techniques using synthetic or xenograft materials to augment cystocele repair, with varying success, and at the cost of a substantial complication rate. Some of the complications described after the use of synthetic mesh are novel and may pose major management problems. Predictors of prolapse recurrence seem of particular relevance in light of the growth of mesh surgery because such predictors could potentially help to select patients for mesh surgery, and help to avoid mesh surgery in those with a low risk of recurrence.

Unfortunately, the search for predictors of prolapse recurrence has been largely unsuccessful to date. Whiteside et al. found a high rate of recurrence (58% Stage 2 or higher at 1 year), with younger age at surgery and advanced/multicompartment prolapse a predictor of

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**Table 1** Relative risks for recurrence of significant cystocele in women with avulsion, determined using clinical and sonographic examinations

<table>
<thead>
<tr>
<th></th>
<th>Clinical cystocele</th>
<th>Cystocele to ≥ 10 mm below the symphysis on US</th>
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<tbody>
<tr>
<td>No avulsion</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Unilateral avulsion</td>
<td>2.9 (1.7–4.4)</td>
<td>3.8 (2.1–5.5)</td>
</tr>
<tr>
<td>Bilateral avulsion</td>
<td>2.8 (1.4–4.3)</td>
<td>4.1 (2.2–5.4)</td>
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US, translabial ultrasound.
failure. Clark et al.\textsuperscript{28} documented increased re-operation rates within 5 years in those who had undergone more than one such procedure previously. Vakili et al.\textsuperscript{13} found an increased risk of recurrence at a median follow-up of 5 months in patients with absent levator contractile activity and increased genital hiatus, the first indication that function and morphology of the levator ani muscle may have some influence on recurrence. Adekanmi et al.\textsuperscript{14} presented a conference abstract in 2005 that suggested fascial defects identified on magnetic resonance (MR) imaging as a major predictor of recurrence (which was present in over 50\% of patients 1 year after anterior colporrhaphy), but images shown at the time raised the possibility that the authors had misidentified levator trauma as fascial defects, and there is no independent confirmation for the diagnosis of fascial defects of the anterior vaginal wall by MR or other imaging methods.

In this audit of traditional anterior colporrhaphy, cystocele recurrence was shown to be common at follow-up after 3–6 years, in keeping with the literature on this subject. We detected a recurrent cystocele in 40\% of patients on clinical examination, and in 41\% of patients on ultrasound examination. Recurrence was strongly associated with levator trauma. The relative risk of prolapse recurrence in women with avulsion was 3.9 (95\% CI, 2.4–5.8) when ultrasound criteria of recurrent cystocele were used, and 2.9 (95\% CI, 1.7–4.5) when using the criterion of a Stage 2+ cystocele on ICS POP-Q assessment. These results confirm data obtained by us in an unrelated retrospective study on 737 women symptomatic for lower urinary tract disorders and prolapse\textsuperscript{29}. Patient satisfaction was relatively low, at 65\%, even though recurrent prolapse was often asymptomatic. The fact that the association between symptoms and recurrent cystocele was so weak is in keeping with the literature, a phenomenon that has led to a discussion regarding the most appropriate outcome parameter after surgery for pelvic organ prolapse.\textsuperscript{30} Prolapse in other compartments may be responsible for symptoms in women without cystocele recurrence on ultrasound or clinical examination, and the denervation that inevitably accompanies vaginal surgery may explain the absence of symptoms in those with objective recurrence.

There are several weaknesses of this study that have to be acknowledged. It is a small series originating from a single center. In addition, we were able to see only about one-third of patients who had undergone an anterior colporrhaphy during the inclusion period between 1 January 2002 and 31 December 2005. This may partly be a result of the frequently advanced age of patients undergoing prolapse surgery, the high prevalence of co-morbidities and the high likelihood of a change of residence in the seventh and eighth decades of life. Another reason is likely to be the socio-economic background of our population in western Sydney, which tends to result in lower research participation rates compared with the central or eastern suburbs of the city. In addition, because about 10\% of attenders had to be excluded because of subsequent surgery, our recurrence rate may be an underestimate. However, the low follow-up rate may have skewed our results, leading to an over-estimate of recurrence rates. This may also have influenced the statistical relationship between surgical failure and avulsion. Either way, only a prospective study design with higher follow-up at different time-points is likely to avoid these limitations, and such a study is currently in progress at our institution.

Some may also consider it a weakness that the study population had been operated on by seven different surgeons, and because most procedures were undertaken in the public healthcare system the true number of surgeons is very likely to include a substantial number of trainees. However, we consider this inhomogeneity a strength, in that our results are likely to reflect outcomes (not of the individual surgeon but rather a composite) that are more likely to be representative of average results after a traditional anterior colporrhaphy performed for anterior vaginal wall prolapse. All patients had undergone a traditional colporrhaphy with fascial plication, without more extensive paravaginal repair. The large number of typical concomitant procedures such as vaginal hysterectomy and posterior repair further strengthens the assumption that the outcomes observed by us are typical for this procedure as it is performed in clinical practice. Originally we had intended to analyze for differences in individual technique. However, because patients had been operated on by seven senior surgeons and a number of junior staff, and because the exact surgical technique was often poorly recorded, we decided to omit any analysis of subgroups.

CONCLUSION

Levator avulsion is associated with a relative risk of 3–4 for cystocele recurrence after anterior colporrhaphy. Levator assessment can identify patients at high risk of recurrence and may be useful as a selection criterion before mesh implantation.

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REFERENCES


