

Chapter 7

The anatomical limits of the posterior vaginal vault toward its use as route for intra-abdominal procedures

J.J. Harlaar

G.J. Kleinrensink

W.C.J. Hop

M. Stark

A.J. Schneider

Surgical Endoscopy 2008 22:1910–1912

Abstract

Background

The use of natural openings for abdominal surgery started at the beginning of the 21th century. A trans Douglas endoscopic device has been designed to perform most of the intra-abdominal operations in women through the pouch of Douglas. The posterior vaginal vault is limited in size and could be damaged by an oversized instrument. This study investigates the optimal dimensions of the instrument by measuring the limiting factor in the passage.

Methods

In ten female embalmed bodies the transversal and sagittal diameter of the fornix posterior vaginalis was measured by two observers. The pouch of Douglas was filled to its maximal capacity with mouldable latex through an open abdomen. By internal vaginal examination the connective tissue borders of the fornix posterior were palpated and the impression in the cast was measured. The mean value of these two diameters was evaluated in this study. The level of agreement between the observers was calculated.

Results

The mean fornix posterior diameter was 2.6 cm (standard deviation, SD 0.5 cm) with a range of 2.0–3.4 cm. The mean difference between the two observers of all measurements was 0.08 cm (not significant). Both observers had an acceptable intraobserver variation. The interobserver agreement was excellent.

Conclusion

Instruments with dimensions within the measured limits can be used safely for intra-abdominal operations via the natural orifice of the vagina.

The 19th century was the era of the laparotomy. Endoscopy was developed in the 20th century. The use of the natural openings for abdominal surgery started at the beginning of the 21th century. A Transdouglas Endoscopic Device (TED) has been designed in order to perform most of the intra-abdominal operations in women through the pouch of Douglas. In order to find what the optimal dimensions of this instrument should be, the limiting factor in the passage of this instrument through the vagina into the abdominal cavity, the fornix vaginalis, has to be measured. We report about these measurements in 10 female embalmed bodies.

Anatomy

The fornix vaginalis is formed anatomically by the vagina around the cervix uteri. It is most spacious dorsally where it is separated from the recto-uterine pouch of Douglas only by vaginal wall and peritoneum. The fornix to Douglas relation is not end-to-end. Douglas continues for a shorter or longer distance along the posterior vaginal wall.^{1,2} In the embryological phase Douglas' pouch is deeper, reaching the perineum. It condenses later into the recto-vaginal septum as the cul de sac moves upward along the full length of the posterior vaginal wall. The recto-vaginal septum then extends from the caudal margin of the recto-uterine peritoneal pouch to the proximal border of the perineal body. It forms a fixation point for the perineal body and stiffens the anterior rectal wall during the defecation.¹

Surgical techniques

The posterior fornix of the vagina has been used as an entrance and as an exit to the pelvic and abdominal cavity in several surgical developments in the last 100 years.^{3,4}

In the first half of the twentieth century the fornix posterior was used as passage for the 1.2 cm diameter culdoscopes. In culdoscopy the pelvic organs were visualized without insufflation and with the patient in knee-elbow position. The technique was used to search for causes of pelvic pain, infertility and for diagnosing adnexal masses.⁵

Later it changed into transvaginal endoscopy with insufflation of the abdominal cavity with CO₂ or fluid.⁶ The fornix posterior here served as a gateway for a Veres needle-trocars system for insufflation as well as for access. The trocar had

a diameter of 3.9 mm and the patient was lying on her back. Complications of the transvaginal route in culdoscopy and transvaginal endoscopy were damage to the surrounding tissues, mostly bleeding of the entry site and puncture of the retroperitoneal rectum and were rarely of a serious nature.⁷

The posterior fornix can also serve as an exit for laparoscopically removed specimen like fibroids, gallbladder or fallopian tube that can not be removed through the abdominal wall without extension of the abdominal incision.

Materials and methods

In ten embalmed female human bodies, who had not undergone any previous pelvic surgery, the transversal and sagittal diameter of the fornix posterior was measured. In case of obesity the vulva was removed in order to get a better access.

The pouch of Douglas was filled to its maximal capacity with mouldable latex through the open abdomen (fig.1). Glycerin was used to reduce the adhesiveness of the cast. By internal vaginal examination the connective tissue borders of the fornix posterior were palpated and an impression was made in the cast (fig. 2).

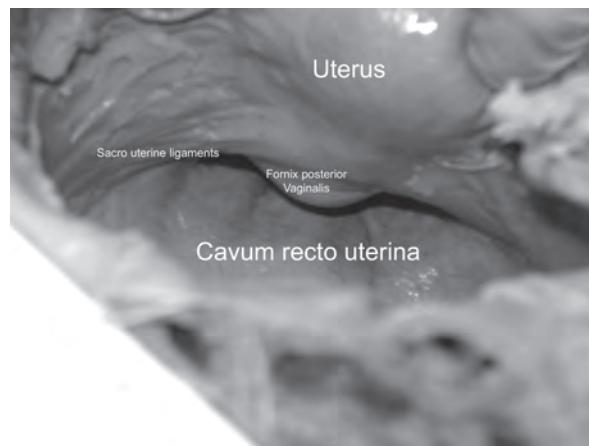


Fig 1 Posterior aspect of the uterus with protruding finger through the vagina into the posterior fornix in the pouch of Douglas.



Fig 2 Impression of the fornix vaginalis in a Douglas pouch cast. The horizontal and vertical lines represent the transversal and sagittal measurement diameter.

The imprint was measured in the transversal and sagittal direction with a marking gauge. Independently two observers conducted five separate measurements in each specimen. A coefficient of variation to assess the intra-observer variety was calculated. The mean values of the 5 measurements were used to calculate the intraclass correlation coefficient as measure of inter-observer agreement. A Bland and Altman plot, a statistical method to look for a systematic bias was used.

Results

The mean fornix posterior diameter in 10 embalmed specimen was 2.6 cm (+/- 0.5 cm) with a range of 2.0-3.4 cm.

Both observers had an acceptable intra-observer variety with a mean coefficient of variation of 8.0% and 6.9%. These did not differ significantly from each other ($p=0.85$, Wilcoxon). Comparing the two observers, the intraclass coefficient was 0.94 (fig. 3, left panel). An intraclass coefficient of more than 0.9 is generally considered to represent excellent agreement.

The mean difference between both observers in all measurements of 0.08 cm was not significant ($p=0.15$ paired T-test). The Bland and Altman plot showed an acceptable limit of agreement (fig 3, right panel).

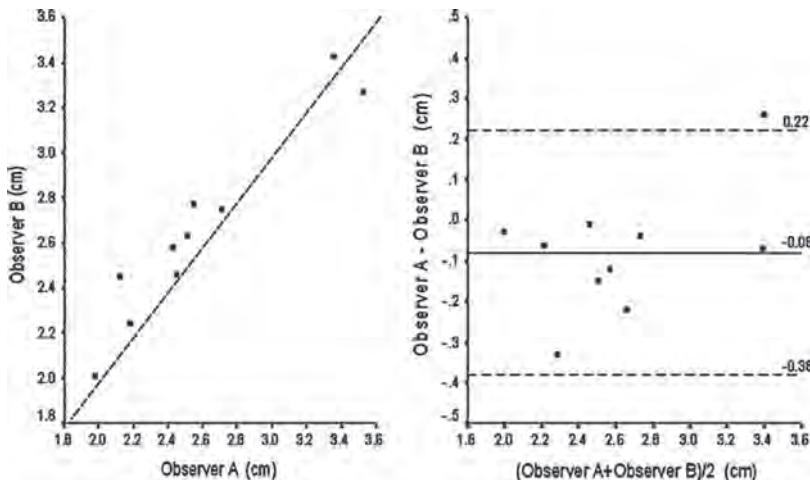


Fig. 3. Left panel: scatterplot of differences of both observers. The dotted line represents the line of identity. Right panel: Bland and Altman plot. The horizontal solid line represents the mean difference, and the two dotted lines represent the limits of agreement (mean \pm 2SD)

Discussion

The full surgical potential of the vagina will be realized in the “one entry, one instrument” principle of this kind of the natural orifice surgery.⁸ The posterior fornix is the bottleneck of the entrée as the rest of the pouch of Douglas is wider. The diameter measured gives an idea to the potential diameter of the instrument. The diameters in embalmed human bodies can be seen as minimal diameters. The rigor mortis and the effect of the embalming have a significant influence upon these diameters. *In vivo* the anatomical limits should be wider. A further issue is the vicinity of the fixation point of the rectovaginal fascia. Depending on the chosen diameter of the instrument this point is in the direct vicinity or further away. The rectovaginal fascia has a considerable clinical significance. If damaged by an oversized instrument the anterior rectal wall may bulge during the straining of defecation, resulting in functional disturbances of bowel movement with possible chronic retention of faeces.

Conclusions

This study supports the feasibility of the posterior vaginal fornix as a safe natural orifice.

The mean anatomical diameter of the posterior vaginal fornix was found to be 2.6 cm (+/- 0.5 cm) with a range of 2.0-3.4 cm. Instruments with these dimensions can be used safely for intra-abdominal operations.

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