

## Lesions of the Pouch of Douglas: A Review

Rutgers University has made this article freely available. Please share how this access benefits you.  
Your story matters. [\[https://rucore.libraries.rutgers.edu/rutgers-lib/50619/story/\]](https://rucore.libraries.rutgers.edu/rutgers-lib/50619/story/)

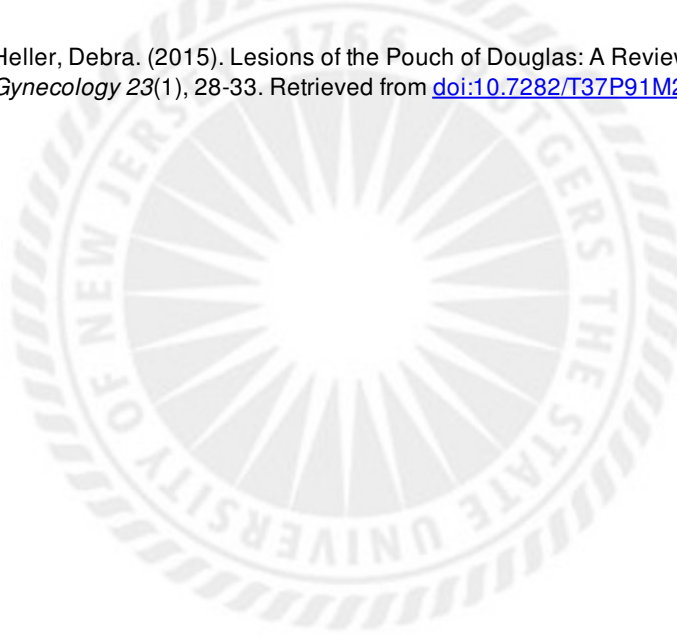
This work is an **ACCEPTED MANUSCRIPT (AM)**

This is the author's manuscript for a work that has been accepted for publication. Changes resulting from the publishing process, such as copyediting, final layout, and pagination, may not be reflected in this document. The publisher takes permanent responsibility for the work. Content and layout follow publisher's submission requirements.

Citation for this version and the definitive version are shown below.

**Citation to Publisher** Heller, Debra. (2015). Lesions of the Pouch of Douglas: A Review. *Journal of Minimally Invasive Gynecology* 23(1), 28-33. <http://dx.doi.org/10.1016/j.jmig.2015.08.878>.

**Citation to this Version:** Heller, Debra. (2015). Lesions of the Pouch of Douglas: A Review. *Journal of Minimally Invasive Gynecology* 23(1), 28-33. Retrieved from [doi:10.7282/T37P91M2](https://doi.org/10.7282/T37P91M2).



**Terms of Use:** Copyright for scholarly resources published in RUcore is retained by the copyright holder. By virtue of its appearance in this open access medium, you are free to use this resource, with proper attribution, in educational and other non-commercial settings. Other uses, such as reproduction or republication, may require the permission of the copyright holder.

*Article begins on next page*

1 Lesions of the Pouch of Douglas-A Review

2 Debra S. Heller, MD

3  
4 From the Department of Pathology & Laboratory Medicine, Rutgers-New Jersey Medical School,  
5 Newark, NJ

6  
7  
8  
9 Address Correspondence to:

10 Debra S. Heller, MD

11 Dept of Pathology-UH/E158

12 Rutgers-New Jersey Medical School

13 185 South Orange Ave

14 Newark, NJ, 07103

15 Tel 973-972-0751

16 Fax 973-972-5724

17 [hellerds@njms.rutgers.edu](mailto:hellerds@njms.rutgers.edu)

18 Word count : 1953

19 Running title: Lesions of the Pouch of douglas

20 Funding: Departmentally funded

21 Disclosures:none

22

23    Precis:

24    Lesions of the Pouch of Douglas are reviewed.

25

26    Key Words: Douglas' Pouch, peritoneal neoplasms

27

28 **Abstract:**

29 Background:

30 The pouch of Douglas may become involved by a variety of mass-like lesions, which may be  
31 challenging to providers who treat women. They may initially be thought to be arising from the  
32 uterus or adnexa. A literature review was conducted. A Medline search was used, using the  
33 terms Douglas' Pouch, Pouch of Douglas, cul-de-sac, and rectouterine pouch. A review of the  
34 scope of Pouch of Douglas lesions is presented to assist in developing a differential diagnosis if a  
35 patient with such a lesion is encountered.

36

37

38

39

40

## 41 **Introduction:**

42 A wide variety of lesions may involve or arise from the Pouch of Douglas(cul-de-sac, POD).  
43 They may initially be thought to be arising from the uterus or adnexa. This paper reviews lesions  
44 of the area, in order to provide assistance in developing a differential diagnosis, if such a patient  
45 is encountered.

46 .

## 47 **Anatomy & Histology**

48 “The cul-de-sac is the rich domain of the gynecologist”(1). Speert goes on to state that the cul-  
49 de-sac allows palpation of the pelvic organs, appreciation of tenderness and masses, is a location  
50 for culdoscopy and aspiration of pelvic abscesses and blood from ectopic pregnancies, as well as  
51 a source of tissue to approximate in enterocele repair(1).The rectouterine space, cul-de-sac, or  
52 Pouch of Douglas(POD), is named after the Scottish anatomist, James Douglas(2), who in a time  
53 where medicine consisted mainly of laxatives and emetics, described many aspects of human  
54 anatomy, including the rectouterine pouch and fold in 1730. Douglas’ other claim to fame, the  
55 debunking of a woman who claimed to give birth to rabbits(1), has not gained quite the same  
56 notoriety. The POD is the space between the posterior uterus and the anterior rectum. It is  
57 bordered laterally by the rectouterine folds, peritoneal folds that extend from the rectum to the  
58 posterior broad ligament at the cervix. This region is further subdivided into the pararectal and  
59 ovarian fossae(3)(Fig 1). The rectouterine folds contain the rectouterine muscle. The POD may  
60 be appreciated on pelvic examination, particularly rectovaginal examination. The POD is lined  
61 by peritoneum, which is comprised of mesothelial cells, similar to the Müllerian lining of the rest  
62 of the pelvic genital organs. Because of the common embryology, the female peritoneum can

63 develop lesions that mimic normal or neoplastic Müllerian structures, hence the peritoneum has  
64 been termed the secondary Müllerian system(4). These lesions include benign lesions such as  
65 endosalpingiosis, endocervicosis, Müllerianosis, endometriosis, and malignancies such as  
66 endometriosis-associated carcinoma, and primary peritoneal carcinoma(5)(Fig 2). In addition,  
67 the peritoneum(mesothelium), is also vulnerable to lesions that may affect mesothelium  
68 elsewhere, such as mesothelial hyperplasia, or the rare malignant mesothelioma. While this  
69 review focuses specifically on the POD, a review of selected peritoneal lesions is available to  
70 interested readers(6). Due to its dependent position in the body, as well as peristalsis(7), the  
71 POD is a common site for metastatic deposits of peritoneal neoplasia, most often ovarian in  
72 women, and gastrointestinal in men(3) as well as abscess formation with peritonitis(3). The  
73 POD has also shown utility as a source of tissue for vaginoplasty in cases of vaginal agenesis(8).

74

## 75 **Evaluation of the POD**

76 The first step in evaluation of the POD is a good physical examination, including a  
77 rectovaginal assessment. A variety of imaging modalities may have utility in evaluating diseases  
78 of the POD. While transvaginal ultrasound is a first line modality for suspicion of ectopic  
79 pregnancy, computerized tomography(CT) imaging has been shown to be useful for detecting  
80 POD tumor implants(9), and magnetic resonance imaging(MRI ) has been lauded in diagnosis of  
81 deep infiltrating endometriosis(10).

82

83

## 84 **Benign lesions**

### 85 **Fluid in the POD**

86 A small amount of fluid may occasionally be present physiologically in the POD, and  
87 transvaginal ultrasound has been shown to be extremely sensitive to its detection, in one study  
88 able to detect 0.8 ml of fluid(11). In one study of 89 pregnant women, 6 had a small amount of  
89 fluid, to a maximum depth of 4 mm. The authors suggested that greater than 2-4 mm depth of  
90 fluid may not be physiologic(12). Fluid in the POD probably accumulates due to this being a  
91 dependent location. POD fluid can be visualized on ultrasound, but is a nonspecific finding, and  
92 may represent a variety of things, including ascites, as well as pus from pelvic inflammatory  
93 disease, fluid in peritoneal tuberculosis(13), blood from a ruptured ectopic pregnancy, or fluid  
94 from a ruptured ovarian cyst(3). An extremely rare cause of blood in the POD is rupture of a  
95 POD vessel in the absence of vaginal trauma, after consensual vaginal intercourse(14).

96 Culdocentesis, while used less than in the past, occasionally has a place in a gynecologic patient.  
97 Culdocentesis has been utilized in the workup of possible ectopic pregnancy, with non-clotting  
98 blood obtained supportive of that diagnosis, although both false positives and false negatives  
99 occur, with a hematocrit of >15% frequently seen in ectopic pregnancies(15). Retrieval of  
100 purulent material may reflect pelvic inflammatory disease. Puncture of the cul-de-sac is also  
101 utilized in ovum retrieval for in vitro fertilization. Ascites may be sampled through the cul-de-  
102 sac, and cytologic evaluation performed for malignancy, however the risk of seeding tumor has  
103 limited the utility of this. A review of the technique with safeguards for this procedure is  
104 available(16).

105

**106 Hernia & genital prolapse**

107 A few rare cases of hernia through the POD have been described(17,18), defined as a  
108 peritoneal internal hernia caused by a defect in the POD peritoneum. The rest of the POD is  
109 undescended in these cases(17,18). This type of hernia may present as small bowel  
110 obstruction(18). Even with radiologic studies, the exact location of a pelvic hernia may be  
111 difficult to localize, and this case was confirmed and repaired laparoscopically.

112 Enterocele, more common than the hernia described above, is descent of the entire POD  
113 peritoneum itself, due to pelvic floor weakness, into the rectovaginal septum. It often contains  
114 small bowel. The cutoff point of an enterocele, as opposed to a deep POD, is unclear. It has been  
115 shown that examination of the patient in the standing position, with an empty bladder, maximizes  
116 appreciation of pelvic organ prolapse(19). Culdoplasty, in some form, has been utilized with  
117 vaginal hysterectomy, to prevent development of enterocele(20). It has been suggested(21) that  
118 obliteration of the POD by approximation of the uterosacral ligaments improved the outcomes of  
119 Burch colposuspension.

**120 Foreign Bodies**

121 The POD is also the rare repository of ingested foreign objects that perforate the  
122 gastrointestinal tract, such as the case of a nail ingested by a child(22). In adults, more  
123 commonly migrated foreign bodies such as IUDs(23) and less common ones, such as spilled  
124 gallstones(24), gossypiboma(25), and a pacemaker(26) have also been described in the POD. In  
125 one case, a levonorgestrel containing IUD was found in the POD of a woman with an  
126 intrauterine first trimester pregnancy, who decided to continue the pregnancy, and subsequently  
127 delivered a viable infant and laparoscopic removal of the IUD(27). The authors suggest



128 individualization of therapy in such a case, with risks of pain, perforation of internal organs,  
129 adhesions, and theoretical risk of masculinization of a female infant due to the higher hormonal  
130 levels in the mother's bloodstream in the ectopic location(27). A POD foreign body may present  
131 as pain or a pelvic mass. It has been stressed that spilled gallstones may produce occasional  
132 severe complications, including infection, adhesions, bowel obstruction or fistulas(28). Foreign  
133 body retrieval may be amenable to laparoscopic procedures(23). Clusters of gallstones seen in  
134 the cul de sac at laparoscopy have been given the quaint name of "blueberry sign", for obvious  
135 reasons(28).

### 136 **Trauma**

137 The POD may be ruptured with intercourse, particularly in nonconsensual sex, and prolapse of  
138 loops of bowel into the vagina is possible(29)

### 139 **Infections and inflammation of the POD**

140 Abscesses in the POD may be secondary to pelvic inflammatory disease, appendicitis, or  
141 ruptured diverticulitis. Postoperatively, blood accumulating in the POD may become infected,  
142 including after excision of deeply infiltrating endometriosis(30)

143 A rare abscess of the POD was described secondary to incarceration and necrosis of the  
144 appendix after uterine perforation during pregnancy termination(31). Mucormycosis, an infection  
145 of immunosuppressed individuals, was described in the POD of a diabetic woman(32). A case of  
146 xanthogranulomatous endometritis formed a POD mass in one fatal case(33).

147 Xanthogranulomatous inflammation is a histologic diagnosis associated with many foamy and  
148 hemosiderin laden macrophages, with multinucleated giant cells. In this case(33), the patient had

149 pyometra, xanthogranulomatous inflammation, and culture proven enterococcus sp. and  
150 Peptostreptococcus magnus.

151 Oil based contrast medium used for hysterosalpingography may cause granulomatous  
152 inflammation that can suggest POD endometriosis at laparoscopy(34). Parasitic infections may  
153 cause POD masses, including pinworm(35), and echinococcal hydatid cysts, which may obstruct  
154 labor(36)

### 155 **Endometriosis**

156 The POD is a common site for endometriosis, and endometriosis in this and the rectovaginal  
157 septum may be associated with significant symptomatology. It has been suggested that the  
158 Masters Allen syndrome may predispose to and/or indicate deep infiltrating endometriosis in this  
159 region (37). Endometriosis may obliterate the POD. On histopathology, the presence of  
160 endometrial glandular epithelium and stroma are required to confirm endometriosis(fig2b),  
161 however many cases are diagnosed clinically at the time of laparoscopy.

162

### 163 **Pregnancy complications involving the POD**

164 Ectopic pregnancies can implant in the POD, and this has been described after in vitro  
165 fertilization(38). POD pregnancy may occur after tubal abortion, or rupture of a tubal ectopic  
166 pregnancy with secondary implantation in the POD(39). One case was described where the POD  
167 ectopic was managed by a combination of systemic and transvaginal intraamniotic  
168 methotrexate(40). Exceptionally rare is a case of complete hydatidiform mole in an ectopic  
169 pregnancy implanted in the POD(41). Because ectopic pregnancies tend to be diagnosed early,  
170 when there is more florid proliferation of implantational trophoblast, hydatidiform mole tends to

171 be over diagnosed in ectopic pregnancies. Ota et al stress that immunohistochemistry with p57  
172 can be useful in some of these cases, as it can confirm a complete mole(41).

173 Intrauterine pregnancies may also involve the POD, as in a case of a uterine perforation  
174 sustained at the time of an 11 week pregnancy termination, with relocation of the fetus to the  
175 POD, identified on ultrasound when the patient developed pain five hours after the  
176 procedure(42). About 15% of uteri are retroverted, and a very rare pregnancy complication is  
177 incarceration of the uterine fundus in the POD in a retroverted uterus. Early diagnosis is  
178 important to mitigate complications. A few such cases have been reduced utilizing the assistance  
179 of colonoscopy(43). Leiomyomas may also become trapped in the POD during pregnancy(44).

180 A rare case of a tear in the POD following a successful VBAC has been described and  
181 the authors stressed the importance of awareness of unusual pain and bleeding associated with  
182 VBAC(45).

183 Rare pregnancy-associated malignancies in the POD have included a malignant placental site  
184 trophoblastic tumor in association with a lithopedion, indicating a prior abdominal  
185 pregnancy(46), and unrelated metastatic disease to the POD during pregnancy, such as a case of  
186 primary osseous adamantinoma, originally from the tibia(47).

187

188

189

190

191

**192 Miscellaneous lesions**

193 The peritoneum of the POD is prone to the same reactive changes as elsewhere in the  
194 peritoneal cavity, and mesothelial hyperplasia may be seen microscopically in association with a  
195 wide variety of lesions, benign and malignant. This may raise concern for an epithelial  
196 neoplasm, but can be shown to be mesothelial by utilization of mesothelial immunostains such as  
197 calretinin.

**198 Benign neoplasms**

199 The most commonly reported neoplasm in the POD is benign cystic teratoma. This can be a  
200 dermoid arising from the ovary that has fallen into the POD due to the increased weight  
201 associated with the contents, or an autoamputated ovarian dermoid(48). It can also arise de novo,  
202 where it is thought to occur due to trapping of germ cells during the fetal migration of germ cells,  
203 and can occur in men(49) as well as women(50).

204 Leiomyomas may be found in the POD. They may be pedunculated uterine fibroids, a  
205 leiomyoma arising from small bowel(51), or parasitic, including from iatrogenic spread after  
206 morcellation(52). An interesting case of an extraovarian fibrothecoma in the POD mimicked a  
207 leiomyoma clinically(53). The authors postulated that the lesion arose in a supernumerary ovary,  
208 although this was not demonstrable histologically.

209 Benign multicystic mesothelioma, a benign multicystic lesion with a high recurrence rate,  
210 may be found in the cul de sac, where it may be free floating, as well as attached, and may be  
211 amenable to laparoscopic resection(54). In one case, it was associated with high serum CA19.9,  
212 which decreased after laparoscopic resection(55). Multicystic mesothelioma may be confused

213 with multilocular peritoneal inclusion cysts, which usually occur after prior surgery, and in fact  
214 may represent the same entity(56).

215 An adenomatoid tumor, a benign mesothelial lesion, has also been reported in the POD(57).

216

217

## 218 **Malignant lesions**

219 Primary malignancies may rarely arise in the POD, of Müllerian origin, and the mechanism is  
220 potentially malignant transformation of endometriosis, although this cannot always be  
221 demonstrated, as the tumor may have overgrown an endometriotic focus. Malignant  
222 transformation of Müllerian remnants is another possibility(58). Müllerian tumors that have  
223 arisen in the POD include adenosarcoma(59,60), carcinosarcoma(58), and clear cell  
224 carcinoma(61). Rarer primary tumors of the POD include malignant placental site trophoblastic  
225 tumor(46), malignant mesothelioma(62), and extragastrointestinal stromal tumor(63), which has  
226 a high local recurrence rate(64).

227 Perhaps because of the dependent location and peristalsis, seeding of tumors within the  
228 peritoneum tends to go to the POD(7), particularly ovarian carcinomas(fig2c), as well as colon  
229 carcinoma(65). Other ovarian neoplasms such as carcinoid have been reported as well(66).  
230 Endometrial carcinoma cells have been documented in the POD after curettage(67), but it is not  
231 clear whether or not that increases the risk of implantation of these cells.

232 Rarely, evaluation of POD fluid may confirm a non-ovarian malignancy, and the modes of  
233 tumor transport may be unusual as well. Some neoplasms, such as pseudomyxoma peritonei in

234 association with an appendiceal primary, may be present in the POD, but culdocentesis may be  
235 difficult and yield little, due to the thick mucinous fluid, scant cellularity in the mucus, and  
236 loculation. Culdocentesis, however, has fallen by the wayside as a diagnostic tool for  
237 malignancy, as there may be risk of seeding a malignant tumor. In one case(68), peritoneal  
238 keratin granulomas were present in the cul de sac, from transtubal spread of an endometrial  
239 adenocarcinoma with squamous differentiation. This finding is more likely associated with  
240 leakage of a benign cystic teratoma(68). Transtubal spread of tubal carcinoma has occurred(69).  
241 Pineal tumors have been transported via ventriculoperitoneal shunts and implanted in the  
242 POD(70). Intestinal lymphoma has presented with effusion in the POD, unusual for a non-  
243 effusion lymphoma, where this is usually a late, not initial finding(71).

#### 244 **Conclusions:**

245 The Pouch of Douglas may be involved in a wide variety of lesions. A knowledge of specific  
246 lesions of the region will be helpful in developing a differential diagnosis, if such a patient is  
247 encountered.

248

249

250 **References:**

251 1-Speert H. James Douglas and the peritoneal cul-de-sac. *Surg Gynecol Obstet* 1955;101:498-  
252 501.

253 2-Brock H. James Douglas of the pouch. *Med Hist* 1974;18:162-72.

254 3-Trenkner SW, Smid AA, Francis IR, Levatter R. Radiological detection and diagnosis of  
255 pouch of Douglas lesions. *Crit Rev Diagn Imaging* 1988;28:367-81.

256 4-Pickartz H. Differential diagnosis of peritoneal lesions of the Mullerian type and similar  
257 epithelial tumors of the peritoneum. *Int J Gynecol Pathol* 193;12:116-19.

258 5-Katre R, Morani AK, Prasad SR, Srabhi VR, Choudhary S, Sunnapwar A. Tumors and  
259 pseudotumors of the secondary Müllerian system with emphasis on cross-sectional imaging  
260 findings. *AJR* 2010;195:1452-9.

261 6-Baker PM, Clement PB, Young RH. Selected topics in peritoneal pathology. *Int J Gynecol*  
262 *Pathol* 2014;33:393-401.

263 7-Carmignani CP, Sugarbaker TA, Bromley CM, Sugarbaker PH. Intraperitoneal cancer  
264 dissemination: mechanisms of the patterns of spread. *Cancer Metastasis Rev* 2003;22:465-72.

265 8-Davydov SN, Zhvitiashvili OD. Formation of vagina (colpopoiesis) from peritoneum of  
266 Douglas pouch. *Acta Chir Plast.* 1974;16:35-41.

267 9-Fujwara K, Yoshino K, Enomoto T, et al. Usefulness of computed tomography in predicting  
268 cytoreductive surgical outcomes for ovarian cancer. *Arch Gynecol Obstet.* 2011;284:1501-7.

- 269 10-Macario S, Chassang M, Novellas Set al. The value of pelvic MRI in the diagnosis of  
270 posterior cul-de-sac obliteration in cases of deep pelvic endometriosis. AJR Am J Roentgenol.  
271 2012 ;199:1410-5.
- 272 11-Nichols JE, Steinkampf MP.Detection of free peritoneal fluid by transvaginal sonography.J  
273 Clin Ultrasound. 1993 ;21:171-4.
- 274 12-Hussain ZJ, Figueroa R, Budorick NE. How much free fluid can a pregnant patient have?  
275 Assessment of pelvic free fluid in pregnant patients without antecedent trauma. J Trauma.  
276 2011;70:1420-3. 13-Makedos A, Mandala E, Makedos G. Diagnosis of peritoneal tuberculosis:  
277 random involvement of gynecologists. Eur J Obstet Gynecol Reprod Biol 2011;159:476-87.
- 278 14-Goswami A, Raghavan SS, Ghotekar LH. Postcoital haematoperitoneum: a cause for shock.  
279 Emer Med Australasia 2004/16:170-1.
- 280 15-Brenner PF, Roy S, Mishell DR Jr. Ectopic pregnancy. A study of 300 consecutive surgically  
281 treated cases. JAMA. 1980 ;243:673-6.16Eisinger, SH. Culdocentesis. J Fam Pract 1981;13:95-  
282 101.
- 283 17-Bunni J, Teichmann D, Berstock JR. Pouch of Douglas pelvic hernia: a rare entity managed  
284 laparoscopically. Hernia 2012;16:601-3.
- 285 18-Inoue Y, Shibata T Ishida T. CT of internal hernia through a peritoneal defect of the Pouch of  
286 Douglas. AJR 2002;179:1305-6.
- 287 19-Silva WA, Kleeman S, Segal J, Pauls R, Woods SE, Karram MM.Effects of a full bladder and  
288 patient positioning on pelvic organ prolapse assessment.Obstet Gynecol. 2004;104:37-41.  
289



- 290 20-Pitkin RM. Commentary on: "Posterior culdeplasty: surgical correction of enterocele during  
291 vaginal hysterectomy: A preliminary report" 1957. *Obstet Gynecol.* 2003;101:625.
- 292 21-Langer R, Lipshcitz Y, Halperin R, Pansky M, Bukovsky I, Sherman D. Prevention of  
293 genital prolapse following Burch colposuspension: comparison between two surgical procedures.  
294 *Int Urogynecol J Pelvic Floor Dysfunct.* 2003;14:13-6.
- 295 22-Klein K, Pegoli W Jr., Lee Y. Transluminal migration o ingested foreign body without  
296 peritonitis. *J Pediatr Surg* 2012;47:788-91.
- 297 23-Balci O, Capar M, Mahmoud AS, Colakoglu MC. Removal of intra-abdominal mislocated  
298 intrauterine devices by laparoscopy. *J Obstet Gynaecol* 2011;31:650-2.
- 299 24-Wittich AC. Spilt gallstones removed after one year through a colpotomy incision: report of a  
300 case. *Int Surg* 2007;92:17-19.
- 301 25-Possover M. Gossypiboma in the Pouch of Douglas. *NEJM* 2008;359:e9.
- 302 26-Garcia-Bengochea J, Rubio J, Sierra J, Fernandez A. Pacemaker migration into the pouch of  
303 Douglas. *Tex Heart Inst J.* 2003;30:8327-Cook J, Martin A, Warren O, Tan TL. Term pregnancy  
304 with LNG-IUS embedded in the rectal mucosa. *J Obstet Gynaecol* 2011;31:546.
- 305 28-Anrique D, Kroker A, Ebert AD. "Blueberry sign". Spilled gallstones after cholecystectomy  
306 as an uncommon finding. *J Minim Invasive Gynecol.* 2013 ;20:329
- 307 29-Haney AF. Vaginal evisceration after forcible coitus with intraabdominal ejaculation. *J*  
308 *Reprod Med* 1978;21:254-6.

- 309 30-Sanguin S, Roman H, Vassilieff M et al. Infected hematoma of Douglas pouch: a specific  
310 complication of the surgical excision of deep endometriosis involving the vagina. *Gynecol*  
311 *Obstet Fertil* 2013;41:149-55.
- 312 31-Dignac A, Novella S, Fournol M, Caramella T, Bafghi A, Chevallier P. Incarceration of the  
313 appendix complicating a uterine perforation following surgical abortion: CT aspects. *Emerg*  
314 *Radiol* 2008;15:267-9.
- 315 32-Mondal PK, Mondal SK, Mondal TK, Saha P. Mucormycosis of Pouch of Douglas in a  
316 diabetic woman. *J Glob Infect Dis* 2012;4:172-4.
- 317 33-Noack F, Briese J, Stellmacher F, Hornung D, Horny H. Lethal outcome in  
318 xanthogranulomatous endometritis. *APMIS* 2006;114:386-8.
- 319 34-Brosskinsky CM, Clark RL, Wilson PA, Novotny DB. Pelvic granulomata mimicking  
320 endometriosis following administration of oil-based contrast media for hysterosalpingography.  
321 *Obstet Gynecol* 2002;83:890-2.35-Vural S, Tahsinoglu M, Giriskan G, Kalaclar F, Ustundag N.  
322 Granuloma in the pouch of Douglas caused by enterobius vermicularis. *Ann Trop Med Parasitol*  
323 1966 ;60:125-8
- 324 36-Dede S, Dede H, Caliskan E, Demir B. Recurrent pelvic Hydatid cyst obstructing labor with  
325 concomitant hepatic primary. A case report. *J Reprod Med* 2002;47:164-6
- 326 37-Farr R. Nezhat, Mohamad S. Mahmoud Allen Masters Peritoneal Defect: A Potential  
327 Pathway to Deep Infiltrating Rectovaginal Endometriosis? *JMIG* 2014;21:321-2.
- 328 38-Shih CC, Lee RK, Hwu YM. Cul-de-sac pregnancy following in vitro fertilization and  
329 embryo transfer. *Taiwan J Obstet Gynecol* 2007;46:171-3.

- 330 39-Giannopoulos T, Katesmark M. Ruptured tubal ectopic pregnancy with secondary  
331 implantation in the pouch of Douglas. *J Obstet Gynaecol* 2004 ;24:199-200.
- 332 40-Crespo R, Campillos JM, Villacampa A, Madani B, Navarro R, Tobajas JJ. Successful  
333 methotrexate treatment of an abdominal pregnancy in the pouch of Douglas. *Clin Exp Obstet*  
334 *Gynecol* 2008;35:289-90.
- 335 41-Ota H, Oda C, Hayashi M, Mikoshiba T, Kushima M. Rare case of peritoneal complete  
336 hydatidiform mole. *J Obstet Gynaecol Res* 2014;40:1154-6.
- 337 42-Gao J, Kazam E, Whalen JP. Detection of the fetus in the cul-de-sac by transabdominal and  
338 transvaginal ultrasound. A case report. *Clin Imaging* 1991;15:296-8.
- 339 43-Dierickx I, Delens F, Backaert T, Pauwels W, Gyselaers W. Case report: incarceration of the  
340 gravid uterus: a radiologic and obstetric challenge. *J Radiol Case Rep.* 2014;8:28-36.
- 341 44-Makar AP, Schatteman EA, Vergote IB, Desmedt E. Myomectomy during pregnancy. *Acta*  
342 *Chir Belg* 1989;89:212-4.
- 343 45-Shantha N, Depares J. An unusual case of tear in the pouch of Douglas following  
344 spontaneous vaginal delivery in a previously scarred uterus. *J Obstet Gynaecol.* 2007;27:87-8.
- 345 46-El Hag IA, Ramesh K, Kollur SM, Salem M. Extrauterine placental site trophoblastic tumour  
346 in association with a lithopedion. *Histopathol* 2002;41:446-49.
- 347 47-Flug JA, Scalcione LAR, Hakima L, et al. Radiologic-Pathologic findings of primary osseous  
348 adamantinoma with unusual metastasis to the posterior cul-de-sac in pregnancy. *Clinical Imaging*  
349 2011;35:483-7.

- 350 48-Kusaka M, Mikuni M. Ectopic ovary: a case of autoamputated ovary with mature cystic  
351 teratoma into the cul-de-sac. *J Obstet Gynaecol Res* 2007;33:368-70.
- 352 49-Makni A, Rhouma SB, Farah J, Jouini M, Kacem M, Safta ZB. A case of mature teratoma of  
353 the douglas. *La tunisie medicale* 2013;91:473-4.
- 354 50-Lefkowitz JH, Fenoglio CM, Richart RM. Benign cystic teratoma of the retrouterine pouch  
355 of Douglas. *Am J Obstet Gynecol* 1078;131:818-20.
- 356 51-Alsinnawi M, Fleming FJ, Kenny BJ, Waldron D. Atypical midcycle pain. *Am J Surg*  
357 2009;197:e1-2.
- 358 52-Larrain D, Rabischong B, Khoo CK, Botchorishvili R, Canis M, Mage G. "Iatrogenic"  
359 parasitic myomas: unusual late complication of laparoscopic morcellation procedures. *J Minim*  
360 *Invasive Gynecol.* 2010;17:719-24.
- 361 53-Honore LH, Barr JS. Cul de sac fibrothecoma simulating a parasitic fibroid. *Aust NJ J Obstet*  
362 *Gynaecol* 1985;25:136-8.
- 363 54-Kanstrup MH, Joergensen A, Grove A. Benign multicystic peritoneal mesothelioma. *Acta*  
364 *Obstet Gynecol Scand* 2002;81:1083-5.
- 365 55-Pinto V, Rossi AC, Fiore MG, D'Addario V, Cicinelli E. Laparoscopic diagnosis and  
366 treatment of pelvic benign multicystic mesothelioma associated with high CA19.9 serum  
367 concentration. *J Minim Invasive Gynecol.* 2010;17:252-4.
- 368 56-Baker PM, Clement PB, Young RH. Selected topics in peritoneal pathology. *Int J Gynecol*  
369 *Pathol.* 2014;33:393-401

- 370 57-Bergholz M, Altmannsberger M, Schauer A. Benign mesothelioma of the cul-de-sac. A tumor  
371 with misleading histologic pattern in an unusual location. *Gynecol Oncol* 1981;11:393-5.
- 372 58-Terada T. Carcinosarcoma in the pouch of Douglas. *Arch Gynecol Obstet* 2010;281:345-8.
- 373 59-Oster AG, Nirenberg A, Ashdown ML, Murphy DJ. Extragenital adenosarcoma arising in the  
374 pouch of Douglas. *Gynecol Oncol* 1994;53:373-5.
- 375 60-Patrelli TS, Silini EM, Gizzo S, et al. Extragenital Mullerian adenosarcomas with pouch of  
376 Douglas location. *BMC Cancer* 2011;11:171.
- 377 61-Shigeta N, Yoshino K, Matsuzaki S, Morii E, Ueda Y, Kumura T. Clear cell adenocarcinoma  
378 of the peritoneum: a case report and literature review. *J Ov Res* 2014;7:86.
- 379 62-Takeuchi K, Fujimoto M, Tsujino T, Takeda Y, Yoshida S. Impressive remission of locally  
380 advanced malignant peritoneal mesothelioma treated with combination of radiotherapy and  
381 intraperitoneal paclitaxel. *Eur J Gynaecol Oncol* 2007;28:322-3.
- 382 63-Peitsidis P, Zarganis P, Trichia H, Vorgias G, Smith JR, Akrivos T. Extragastrointestinal  
383 stromal tumor mimicking a uterine tumor. A rare clinical entity. *Int J Gynecol Cancer*  
384 2007;18:1108-31.
- 385 64- Vasquez J, Perez-Pena M, Gonzalez B, Sanchez A. Gastrointestinal tumor arising in the  
386 rectovaginal septum. *J Lower Gen Tract D* 2012;16:158-61.
- 387 65-Sato H, Maeda K, Kuroda M, Maruta M. Poorly differentiated adenocarcinoma in the  
388 ascending colon with peritoneal dissemination: case report of a patient who survived more than  
389 eleven years. *Acta Gastroenterol Belg* 2008;71:321-4.

- 390 66-Ogawa H, Nishio A, Satake H et al. Neuroendocrine tumor in the breast. *Radiat Med*  
391 200;26:288-32.
- 392 67-Kuzel D, Toth D, Kobilkova J, Dohnalova A. Peritoneal washing cytology on fluid  
393 hysteroscopy and after curettage in women with endometrial carcinoma. *Acta Cytol*  
394 2001;45:931-5.
- 395 68-Wotherspoon AC, Benjamin E, Boutwood AA. Peritoneal keratin granulomas from transtubal  
396 spread of endometrial carcinoma with squamous metaplasia(adenocanthoma). Case report. *Br J*  
397 *Obstet Gynaecol* 1989;96:236-40.
- 398 69-Kirshtein B, Meirovitz M, Okon E, Piura B. Sister Mary Joseph's nodule as the first  
399 presenting sign of primary fallopian tube adenocarcinoma. *J Minim Invasive Gynecol*  
400 2006;13:234-6.
- 401 70-Wood BP, Haller JO, Berdon WE, Lin SR. Shunt metastases of pineal tumors presenting as a  
402 pelvic mass. *Pediatr Radiol* 1979;8:108-9.
- 403 71-Ljubic N, Sucic M, Vasilj A et al. Cytological detection of lymphoma in Douglas aspirate.  
404 *Diagn Cytopathol* 2008;36:729-33.
- 405

406 Legends:

407 Figure 1- Pelvic exenteration for cervical carcinoma, extending anteriorly to the bladder. The  
408 POD is free of tumor(arrow).

409 Figure2-Patient with endometriosis who developed mixed clear cell and endometrioid carcinoma  
410 of the ovary. Biopsy of the POD showed endosalpingiosis(2a), with a tubal-type lining and no  
411 surrounding stroma, endometrioisis(2b), showing endometrial type stroma between  
412 glands(arrow), and endometrioid carcinoma(2c), showing more atypical glands. Lymphovascular  
413 space involvement was present(inset), and the endothelial lining of the lymphovascular  
414 space(arrow) is confirmatory that the space is a lymphovascular space.

415

416