

1 **A systematic review and meta-analysis on fetal ovarian cysts: impact of size, appearance and prenatal**
2 **aspiration.**

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17 What's already known about this topic?

18 Fetal ovarian cysts have long been associated with a risk of torsion pre- and post-natally; cyst size is a
19 known risk factor for torsion. Until now there has been no estimate of the risk of torsion according to
20 ovarian cyst size. Prenatal ultrasound guided cyst aspiration is used rarely and its efficacy is still debated.
21 The scarcity of cases increases the challenge to design studies and answer the pertinent clinical questions.

22

23 What does this study add?

24 In this systematic review and meta-analysis we quantified the risk of torsion according to ovarian cyst size.
25 Furthermore, we were able to perform comparison of simple cysts ≥ 40 mm to identify the potential benefit
26 of prenatal aspiration over conservative management. Finally, we estimated the proportion of cases that
27 torsted pre-natally and again relate this to the size at diagnosis.

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41 **Abstract**

42 **Objective**

43 To compare outcomes of ultrasound-guided aspiration of fetal ovarian cysts with conservative management.

44 **Method**

45 A systematic review of MEDLINE and Web of Science included studies reporting outcomes (pre- and post-
46 natal torsion, spontaneous resolution, and surgery) of fetuses with ovarian cysts. Subgroup analysis was
47 performed according to cyst diameter at diagnosis and cysts ≥ 40 mm.

48 **Results**

49 92 non-randomized studies reported on 380 cysts (324 observed, 56 aspirated in-utero) in 365 fetuses. All
50 studies were case reports or series with high heterogeneity and risk of bias. The overall spontaneous
51 resolution rate of conservatively managed cysts was 46%, yet decreased with increasing cyst size. Risk of
52 prenatal ovarian torsion in conservatively managed cases depended on cyst size and was particularly
53 important in the range 30-59mm (15-34%). The rate of prenatal torsion in simple cysts ≥ 40 mm was lower
54 in aspirated than conservatively managed cysts (0% versus 10%, $p=0.03$). Aspirated cysts had lower rates
55 of postnatal surgery (7%) compared to conservatively managed cysts (49 %, $p<0.001$).

56 **Conclusion**

57 30–59mm cysts were at highest risk of torsion. Simple cysts >40 mm had lower rates of torsion when
58 aspirated prenatally. Randomized studies and safety data are needed prior to routine prenatal ovarian
59 cyst aspiration.

60

61

62 **Introduction**

63 The incidence of fetal ovarian cysts has been estimated to be as high as 1 in every 1,000 fetuses.¹ The
64 suspected mechanism for the formation of ovarian cysts in-utero is a dysregulated response of follicles to
65 high levels of estradiol and gonadotrophins. Ovarian cysts are not considered pathologic unless they are
66 at least 20mm in greatest diameter,² and smaller cysts of at least 1mm in size are common. In one study
67 of 332 neonatal deaths and stillbirths ovarian cysts were found to be present in 34% of cases and were
68 increasingly common later in gestation.¹⁸ In case reports, ovarian cysts have been associated with
69 hypothyroidism, diabetic mothers, and pregnancies complicated by rhesus isoimmunisation, but these
70 associations have not been confirmed in larger studies. Ovarian malignancies are exceedingly rare in the
71 prenatal/neonatal period, with only one reported in a large case series, and in a further series of 91
72 paediatric ovarian tumours, none were found before the age of one year.^{12 20}

73 For the past three decades fetal ovarian cysts have been increasingly diagnosed through the use of
74 prenatal ultrasound. Despite the rapid increase in the number of cases and cohorts that have been
75 reported in the literature, there remains uncertainty regarding their pre- and post-natal management.
76 Cysts can undergo torsion in utero, resulting in loss of the ovary, fallopian tube, or both, which could
77 compromise future fertility. Very large cysts distend the fetal abdomen and could lead to dystocia in
78 labour. The risk of torsion with fetal ovarian cysts has led groups to perform prenatal ultrasound guided
79 aspiration in larger simple cysts with the aim to reduce the chance of prenatal torsion.^{3, 4} A balance is
80 needed however between the potential for complications from ultrasound guided prenatal aspiration
81 including haemorrhage, preterm premature rupture of the membranes (PPROM) and preterm birth,
82 against the risk of prenatal torsion. Indications for performing cyst aspiration vary, with some groups
83 reporting aspirating only simple cysts with a diameter of 40 or 50mm or greater.^{5 6 7} Prenatal aspiration
84 has been reported to result in lower rates of ovarian torsion compared to conservative management, but
85 few studies have used this method and there still remains significant doubt on its safety and results.⁵

86 Even the significance of a complex or simple appearance to the cyst has been subject to debate, especially
87 in the management of cysts post-natally. Retrospective cohort studies suggest that ovarian loss is more
88 common in complex cysts.⁵ Ovarian cysts which already have undergone torsion are more likely to be
89 complex in appearance, thus surgery for complex cysts may be less likely to be beneficial. Many
90 practitioners therefore propose that only women whose fetus has a simple ovarian cyst be offered
91 prenatal aspiration.⁶⁸ A complex cyst poses diagnostic uncertainty and some authors suggest that it is an
92 indication for post-natal surgery.⁸

93 While a consensus exists in the adult literature that there is a higher risk of torsion for larger simple and
94 complex ovarian cysts, it remains unclear at which size torsion becomes a significant risk when ovarian
95 cysts are diagnosed *in utero* or in infants.⁸⁷

96 **Objectives**

97 We performed a systematic review and meta-analysis of pregnant women whose fetus had a prenatal
98 diagnosis of an ovarian cyst to investigate how the outcomes of cyst resolution, post-natal surgery, and
99 prenatal torsion after prenatal aspiration compared with conservative management. We also aimed to
100 identify the risk of ovarian torsion according to size and sonographic appearance of ovarian cysts in those
101 cases managed conservatively.

102

103 **Methods**

104 A Medline® and Web of Science™ search of journal articles for: (fetal OR antenatal* OR prenatal* OR
105 neonatal) AND ovarian AND cyst* was performed electronically on December 16th, 2014, for studies
106 published from 1980 to the search date. Titles and abstracts were screened for relevance by two reviewers
107 (AT and SB), relevant references were reviewed in full and disagreements were resolved through

108 discussion and consensus; references were managed using Endnote™ software. All relevant articles were
109 read in full by AT and SB. The study population was any patient with a prenatally diagnosed ovarian cyst,
110 and outcomes investigated were: cyst resolution, pre or post-natal torsion, or surgery. The studied
111 intervention was prenatal aspiration or conservative management. The inclusion criteria for our meta-
112 analysis was any study which individually and separately stated for each of their study patients data on
113 the greatest diameter of each individual ovarian cyst at time of diagnosis, and followed up with
114 radiological investigations until one of the specified outcomes was reached. The inclusion criteria for the
115 aspirated group also allowed for inclusion of studies that set clear size criteria for performing aspiration
116 if individual sizes were not given (e.g. greater than 40mm), and undertook follow-up with radiological
117 investigations for the same aforementioned outcomes. Both retrospective and prospective studies were
118 included and animal studies were excluded. Eligible studies included were of English, French, Spanish or
119 German language. Furthermore, any study which grouped the cohort of conservatively managed patients
120 together and did not report individual size at diagnosis and outcomes was excluded. The study protocol
121 was modified according to Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA)
122 guidelines. Risk of bias assessment was performed on included studies using the QUADS-2 tool.¹¹⁶

123 Outcomes which we investigated were: resolution of the cyst with an ovary present, resolution of a cyst
124 with no detectible ovary, prenatal torsion, total torsion, and surgery. Further variables collected were cyst
125 size at the time of diagnosis and sonographic appearance at the time of diagnosis. Data for each eligible
126 study were entered into a central database independently and then subsequently reconfirmed.

127 We defined prenatal torsion as either: intrauterine ovarian auto-amputation, “wandering” cyst prenatally
128 with absent ovary at first neonatal scan, or ovarian necrosis confirmed from histological sample taken at
129 time of surgery within the neonatal period in an otherwise asymptomatic neonate. If age at operation was
130 not precisely stated then other evidence was taken into account to determine time of torsion. The total

131 torsion group included babies who developed symptoms of torsion at any age, and who had surgery with
132 histological confirmation of torsion in or after the neonatal period. Where available we gathered the
133 appearance of the cyst on ultrasound (simple or complex) according to the Nussbaum criteria.⁹

134 Absolute risk was reported and proportions were compared using a two tailed Fisher's exact test on
135 GraphPad Prism 6[®] software. Data were also meta-analyzed taking into account between-study
136 differences using a random binary effects model in MetaAnalyst 3.1 in order to generate confidence
137 intervals. Sensitivities and specificities were calculated and the Receiver operating characteristic (ROC)
138 curve was plotted on GraphPad Prism 6[®].

139 A subgroup analysis was performed on any ovarian cysts that were 40mm or larger at the time of diagnosis
140 comparing conservatively managed cysts to those treated with prenatal aspiration. Furthermore, this
141 comparison was repeated for a further subgroup of only simple ovarian cysts that were 40mm or larger
142 at diagnosis.

143

144 **Results**

145 **Search Results**

146 The MEDLINE[®], and Web of Science[™] search yielded 1,172 articles of which 263 were relevant, with a total
147 of 1,663 patients. Of those articles, 114 were included for a qualitative analysis. Five articles were
148 excluded due to being review articles and 169 articles were excluded as they did not meet our inclusion
149 criteria, leaving 89 articles that met the inclusion criteria for the meta-analysis. All included studies were
150 observational studies, no randomised controlled trial was found. Details on all studies are included in the
151 Supplementary Table. 373 patients were included in our study with a total number of cysts included in
152 the meta-analysis of 380. 7 patients had bilateral ovarian cysts over 20mm. The literature was largely

153 heterogeneous. Variability was seen amongst different authors in: indications for surgery, indications for
154 aspiration, interpretations of US findings, and methods of reporting data. Furthermore, 75% of the papers
155 included had 10 patients or less.

156 **Ovarian cyst cases**

157 324 cysts were treated conservatively by observation alone prenatally and 56 cysts underwent ultrasound
158 guided prenatal aspiration. Gestational age at diagnosis was available for 270 fetuses with conservatively
159 managed cysts (median gestational age at diagnosis = 33 weeks, inter-quartile range 31-35 weeks).
160 Gestational age at diagnosis for aspirated cysts was available for 29 of the patients. The median
161 gestational age at diagnosis was 32 weeks, and the inter-quartile range was 30 – 33 weeks.

162 Table 1 outlines the number of patients in each ovarian cyst size group and the frequency of the following
163 outcomes: cyst resolution without any postnatal surgery, prenatal cyst resolution, total torsion (prenatal
164 and postnatal), prenatal torsion, and postnatal surgery.

165 **Spontaneous cyst resolution**

166 Only 10% of the cysts resolved prenatally in the conservatively managed group, with highest rates in
167 smaller cysts measuring 20-29mm (26%), and lower resolution rates for cysts measuring greater than
168 40mm (3%-9%). The overall spontaneous resolution rate of conservatively managed ovarian cysts was
169 46%. Small cysts under 29mm had a high rate of spontaneous resolution when managed conservatively
170 (87%). The rate of spontaneous resolution diminished with increasing cyst size to rates of 17 – 21% for
171 cysts 60mm or larger. Of the 56 cysts prenatally aspirated, 13 (23%) resolved completely during the
172 prenatal period following aspiration, however, of the 324 ovarian cysts conservatively managed, only 34
173 (10%) resolved spontaneously prenatally ($p=0.01$). Furthermore, significantly more cysts of the prenatally
174 aspirated group required no post-natal intervention (82% vs. 46% $p<0.001$), Table 1.

175 **Torsion**

176 The rate of total torsion (prenatal or postnatal, Figure 1A) , and the rate of prenatal torsion (Figure 1B)
177 was evaluated according to prenatal ovarian cyst size. When comparing the rate of torsion in the prenatal
178 aspiration group (11%) to the conservatively managed groups, there was no difference in the rate of
179 torsion for ovarian cysts measuring 20-29mm (10%, $p=0.54$), 30-39mm (20%, $p=0.11$) or 80-110mm (18%,
180 $p=0.39$). However, cysts measuring between 40-79mm did have higher rates of total torsion if managed
181 conservatively when compared to the prenatally aspirated group as follows: 40-49mm group (39%,
182 $p<0.001$), 50-59mm group (43%, $p<0.001$), 60-69mm group (35%, $p<0.01$), and 70-79mm group (45%,
183 $p<0.001$).

184 Rates of prenatal torsion are more informative in identifying if prenatal aspiration is effective in
185 preventing ovarian accidents and are displayed in Figure 1B. The overall rate of prenatal torsion in the
186 aspiration group was 4%. This was not significantly different from the rate of prenatal torsion in
187 conservatively managed cysts of the following sizes: 20-29mm (3%, $p=0.45$), 60-69mm (12%, $p=0.14$), and
188 80-110mm (18%, $p=0.12$). However the prenatal torsion rate was significantly higher in cysts sized 30-
189 39mm (15% $p=0.02$), 40-49mm (27% $p<0.001$), 50-59mm (34% $p<0.001$), and 70-79mm (21% $p=0.02$).

190 **Postnatal Surgery**

191 The aspiration group also had lower rates of surgery postnatally (7%) compared to the conservatively
192 managed cyst group (49%, $p<0.001$). Larger cysts had higher rates of postnatal surgery compared to the
193 aspirated group ranging from 25% for cysts measuring 30-39mm up to 82% for those measuring 80-
194 110mm (Table 1). Only the 20-29mm cyst size group did not have an increased frequency of postnatal
195 surgery (10%, $p=0.70$).

196

197 **Cysts of 40mm and greater**

198 Most groups performing prenatal aspiration used a minimum cyst size of 40-50mm as their cut-off
199 criterion. In order to compare similar ovarian cyst size groups, we compared outcomes in conservatively
200 managed cysts with aspirated cysts that measured greater than or equal to 40mm (Figure 2). For all
201 outcomes, the frequency was significantly higher in the conservatively managed cysts when compared to
202 the aspirated cysts: total torsion rate (39% vs 12%, $p<0.001$) prenatal torsion rate (25% vs 4%, $p<0.001$)
203 and postnatal surgery rate (63% vs 8%, $p<0.001$, (Figure 2).

204 The majority of aspirated ovarian cysts were simple at the time of diagnosis. It is known that complex
205 ovarian cysts have a higher likelihood of having already undergone torsion when compared to simple
206 cysts. We therefore performed the same ≥ 40 mm analysis but only included ovarian cysts that the authors
207 stated were simple at diagnosis in the conservatively managed group, and excluded the complex cysts in
208 the aspirated group. In this further analysis, there were 97 cases of simple ovarian cysts ≥ 40 mm that were
209 conservatively managed, and 48 cases ≥ 40 mm in the aspirated group. The higher complication rates still
210 persisted in the prenatal conservatively managed group compared to the aspiration group: prenatal
211 torsion rate 10% vs 0% ($p=0.03$); total torsion rate 24% vs 8% ($p=0.03$), postnatal surgery rate 62% vs 8%
212 ($p<0.001$).

213 Using the data of only conservatively managed cases with torsion and those that did not undergo torsion,
214 we investigated the ability of the largest prenatally measured diameter of an ovarian cyst to predict
215 torsion through an ROC curve (Figure 3). Although the diagnostic accuracy of the greatest diameter alone
216 was not high it was significant: the area under ROC curve was 0.58 ($p=0.045$, 95% confidence interval 0.54-
217 0.66). Table 2 outlines the sensitivity and specificity of the ovarian cyst diameter on prenatal ultrasound
218 to predict prenatal torsion.

219 **Discussion**

220 Our findings support the role of prenatal ultrasound guided aspiration of ovarian cysts as a means to
221 reduce rates of fetal ovarian torsion and postnatal surgery. We found significantly lower rates of total
222 torsion in the group of cysts that underwent prenatal aspiration when compared to ovarian cysts treated
223 conservatively that measured between 40-79mm. There was also significantly lower rates of prenatal
224 torsion for cysts measuring 30-59 mm and 70-79mm that were aspirated prenatally. However, due to the
225 low quality of studies included in the analysis the strength of the recommendation remains very low
226 according to the GRADE scoring system.¹¹⁵ Prenatal aspiration of complex cysts had an at least 50% rate
227 of torsion and no evidence is currently available advocating for its use. Caution is advised in interpreting
228 these data aso there were only 4 complex cysts aspirated prenatally in the literature.

229 Given the available data in the currently published literature, we found evidence that the risk of prenatal
230 torsion increases with size of the cyst at the time of diagnosis. Interestingly, the risk of prenatal torsion
231 was highest in the 50-59mm group followed by the 40-49mm group with the risk declining for larger and
232 smaller cysts. A potential explanation of this finding may be that larger cysts are less mobile within the
233 fetal abdomen and therefore less likely to undergo torsion and that the smaller cysts have a lower intrinsic
234 risk of torsion. The highest rates of total torsion were in the 70-79mm group followed by the 50-59mm
235 group.

236 In our meta-analysis, the rate of prenatal resolution was only 10%. This may be explained by the
237 persistently elevated hormonal levels in gestation from the pregnant mother. Postnatally, several groups
238 have shown that there is a tendency towards resolution of ovarian cysts within 6-12 months of life,
239 probably due to the decreased hormonal stimulus.^{10,11}

240 Rates of ovarian loss in complex cysts were variable but high in all the large published series— ranging from
241 44%-89%.^{5,8,12,13} The significance of unilateral ovarian loss in future fertility and endocrine function is
242 particularly difficult to evaluate in the modern age of widespread contraceptive use. Furthermore, studies
243 addressing this topic are scarce and inconclusive.

244 Heling et al. pointed out that 11% of their patients with complex cysts who underwent surgery did have
245 twisting but nevertheless the ovary was viable. Thus in a small subgroup of complex cysts ovarian salvage
246 is still possible. There is however no reliable way to differentiate torsion from a haemorrhagic cyst apart
247 from an operation. Some groups have also stated a high rate of haemorrhagic conversion at birth,
248 especially with vaginal delivery – these cases saw higher rates of isolated haemorrhage rather than torsion
249 in their cysts.¹⁴ Regarding simple cysts, Galinier et al. concluded that they do not require surgical
250 intervention.⁸ However, they also reported that 51% of those simple cysts converted to complex cysts,
251 and that the total rate of ovarian loss in their complex series was 86.5%. Similarly, Bagolan et al. reported
252 that 21% of their simple cysts converted to complex and underwent torsion.⁵

253 The effectiveness of ovarian cyst aspiration in neonates is also unclear, as there are no large case series
254 using this treatment method. Some authors have stated that it may prevent unnecessary operation,
255 however others have observed that re-accumulation of the cyst fluid often occurs requiring multiple
256 interventions.^{8,15} One study found 1 in 5 of their patients required a second aspiration.¹⁶ Re-accumulation
257 of fluid is also a risk with prenatal aspiration – one study found that 10 of 14 antenatally had a recurrent
258 cyst in the follow-up US.⁶⁺ Therefore, when counselling the parents, clinicians should be aware that the
259 only definitive form of treatment is surgery and that cysts aspirated pre- or post- nately should be
260 monitored for fluid re-accumulation.¹⁷

261 Although rare, other complications of fetal ovarian cysts are noteworthy. There have been several
262 publications of haemorrhage into the cyst significant enough to cause fetal anaemia requiring transfusion

263 or delivery.^{25,26} Another case report described displacement of thoracic organs due to the sheer size of
264 the cyst, which had grown to 100mm by the 30th week of gestation, and prenatal aspiration was
265 employed.²⁷ Jeanty et al. identified 19 cases in the literature who presented postnatally with bowel
266 obstruction and were found intraoperatively to have a mobile ovarian cyst thought to have caused
267 inflammation and adhesions.²⁹ The risk of a persistent autoamputated cyst has not been compared to the
268 risk of laparoscopy in causing adhesions, and there is diverging opinion regarding the management of
269 these cases.^{29,30} Finally, there has been one case in the published literature of an asymptomatic infant
270 with bilateral ovarian torsion at elective postnatal surgery who was found antenatally to have bilateral
271 ovarian cysts.⁹⁹

272 **Limitations and risk of bias**

273 There have been no randomised controlled trials on the management of fetal ovarian cysts, and all studies
274 identified were case series with high heterogeneity and risk of bias. There was some variability in the
275 outcomes reported and a high degree of variability on the management pathways of the different
276 included studies. A comprehensive assessment of the studies included using the QUADAS-2 tool is
277 summarised in Supplementary Figure 1. The frequency of prenatal ultrasound scans, timing of postnatal
278 investigations and indications for postnatal surgery differed greatly between the studies.

279 Publication bias is a significant risk in the aspirated cases. Most (32 of 56) of the patients treated by
280 prenatal aspiration were treated in one of two centres, and the small number of publications did not allow
281 for a funnel plot to be generated. Confounding factors, namely clinical expertise, could also have lead to
282 better results in these two centres.

283 Another key factor is the accuracy of prenatal diagnosis. Bagolan et al. excluded 5 (7%) patients from their
284 study due to inaccurate prenatal diagnosis. Other studies have also shown that definitive diagnosis is not

285 always possible by prenatal US.¹⁴ This is relevant as the accuracy of diagnosis of the observed cysts is
286 unlikely to have been 100%. Furthermore, this uncertainty may add to the risks when performing prenatal
287 aspiration, albeit allowing for the confirmation that the cyst is indeed of ovarian origin, by cytological
288 examination and measurement of fluid estradiol and progesterone concentration. Prenatal aspiration for
289 purely diagnostic purpose is not advocated by any group.

290 Finally, the majority of published studies have not described the obstetric or fetal complications
291 associated with prenatal aspiration or conservative management, and simply stated that no complication
292 was observed. Gestational ages at birth were not always described in studies, which would have allowed
293 an assessment of the risk of preterm birth in either comparison group. One study did provide gestational
294 ages at birth of their 13 patients treated by prenatal aspiration and found the median gestation age at
295 birth to be 40 weeks with a range of 35 to 41 weeks.⁴ Risks to the fetus include haemorrhage and injuring
296 nearby structures, as well as accumulation of the cyst. Further studies need to be carried out in order to
297 better quantify the adverse events associated with both management options.

298

299

300 **Conclusion**

301 Risk of total and prenatal torsion is associated with size with the highest risk seen in cysts of 40-59mm at
302 the time of diagnosis. In simple cysts greater than 40mm there is a significantly lower risk of torsion and
303 prenatal torsion in cysts treated with antenatal aspiration.

304 The current body of evidence is made of low quality studies of high heterogeneity and subject to
305 significant biases, especially publication bias. Ideally, management options such as prenatal aspiration
306 need to be studied by randomized controlled studies, as information on procedure safety and adverse

307 events has been severely lacking. However, the low frequency of these cysts makes this particularly
308 challenging. Thus, a multicentre RCT study would be necessary to confirm the findings that prenatal
309 aspiration significantly decreases the rate of torsion in simple cysts with a diameter measuring greater
310 than 40mm.

311

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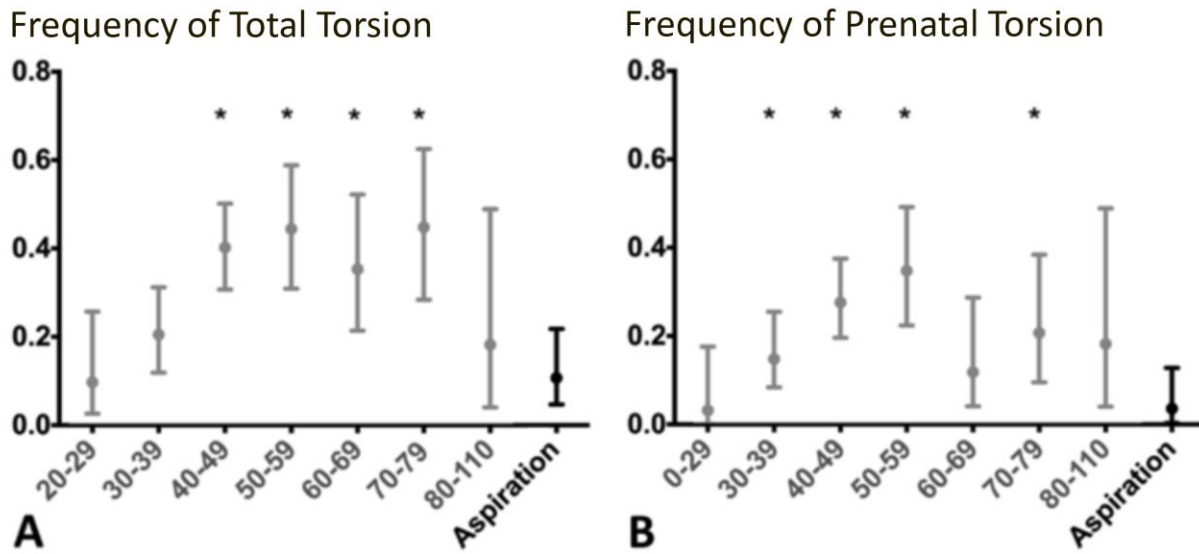
590 **Table 1.** The frequency of outcomes according to the size group of the cysts. Prenatal torsion is defined
 591 as those cysts that were confirmed as torting before birth. Overall torsion is torsion either prenatally or
 592 postnatally. Postnatal surgery may have been performed for indications such as torsion, cyst size or
 593 complexity, compression of abdominal organs or ruling out malignancy.

Cyst Size (mm)	Number of Cysts	Overall Cyst Resolution (%)	Prenatal Cyst Resolution (%)	Prenatal Torsion (%)	Overall Torsion (%)	Postnatal Surgery (%)
Conservatively managed ovarian cysts						
20-29	31	27 (87)	8 (26)	1 (3)	3 (10)	3 (10)
30-39	79	53 (67)	16 (20)	12 (15)	16 (20)	20 (25)
40-49	96	39 (41)	4 (4)	26 (27)	37 (39)	50 (52)
50-59	44	15 (34)	3 (7)	15 (34)	19 (43)	27 (61)
60-69	34	7 (21)	1 (3)	4 (12)	12 (35)	26 (77)
70-79	29	5 (17)	1 (3)	6 (21)	13 (45)	23 (79)
80-110	11	2 (18)	1 (9)	2 (18)	2 (18)	9 (82)
Total Prenatal Conservatively Managed	324	148 (46)	34 (10)	66 (20)	102 (31)	158 (49)
Prenatally Aspirated Ovarian Cysts						
Total Prenatal Aspiration	56	46 (82)	13 (23)	2 (4)	6 (11)	4 (7)

594

595 **Figure 1. A** – The frequency of total torsion (prenatal or postnatal) according to ovarian cyst diameter. **B**
 596 The frequency of prenatal torsion according to ovarian cyst diameter. * P value < 0.05 indicates the
 597 comparison between the frequency of total torsion or prenatal torsion in each ovarian cyst size group and
 598 the respective frequency in the aspiration group. Error bars show the ± 95% confidence interval.

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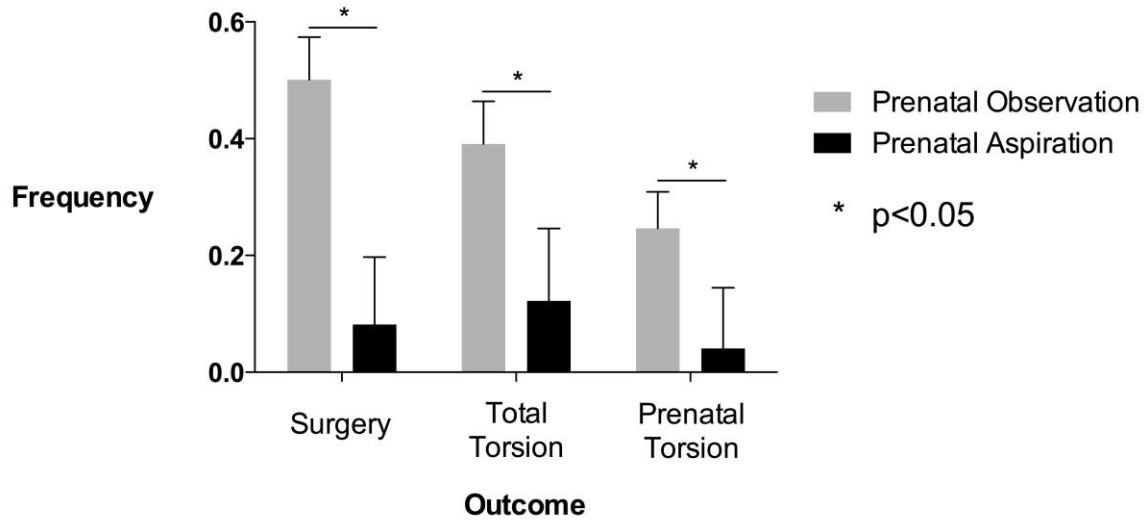
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605 **Figure 2.** A comparison of the frequency of outcomes in cysts greater than or equal to 40mm treated
606 conservatively or by prenatal aspiration.

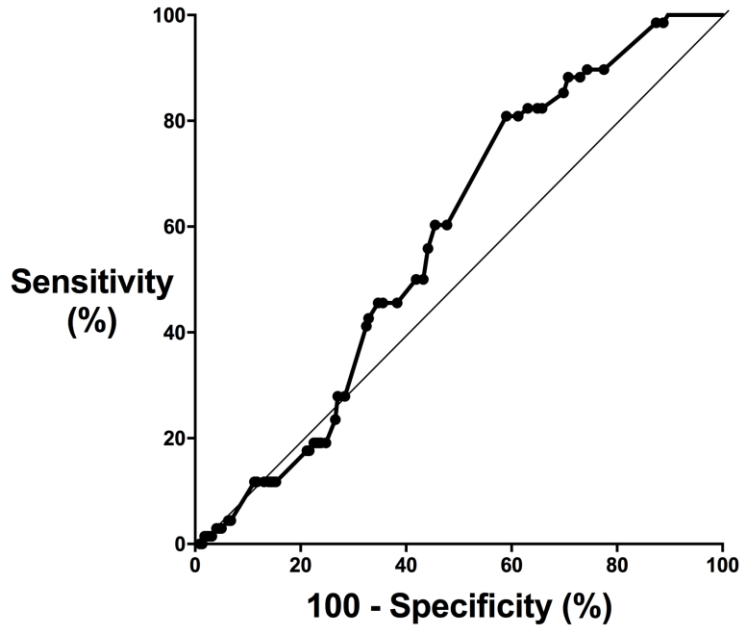


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610 **Figure 3.** ROC curve for the performance of the greatest diameter of an ovarian cyst on prenatal
611 ultrasound for prenatal torsion.



612

613

614

615 **Table 2.** The sensitivity and specificity of the greatest cyst diameter at the time of diagnosis for prenatal

616 torsion

Greatest Diameter (mm)	Sensitivity (%)	Specificity (%)
≥ 20	100	3
≥ 30	99	13
≥ 35	85	30
≥ 40	81	41
≥ 45	50	58
≥ 50	41	68
≥ 60	18	79
≥ 70	12	89
≥ 80	3	96

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